THE TOOL ENGINEER

OFFICIAL PUBLICATION OF THE ASTE AMERICAN SOCIETY OF TOOL ENGINEERS

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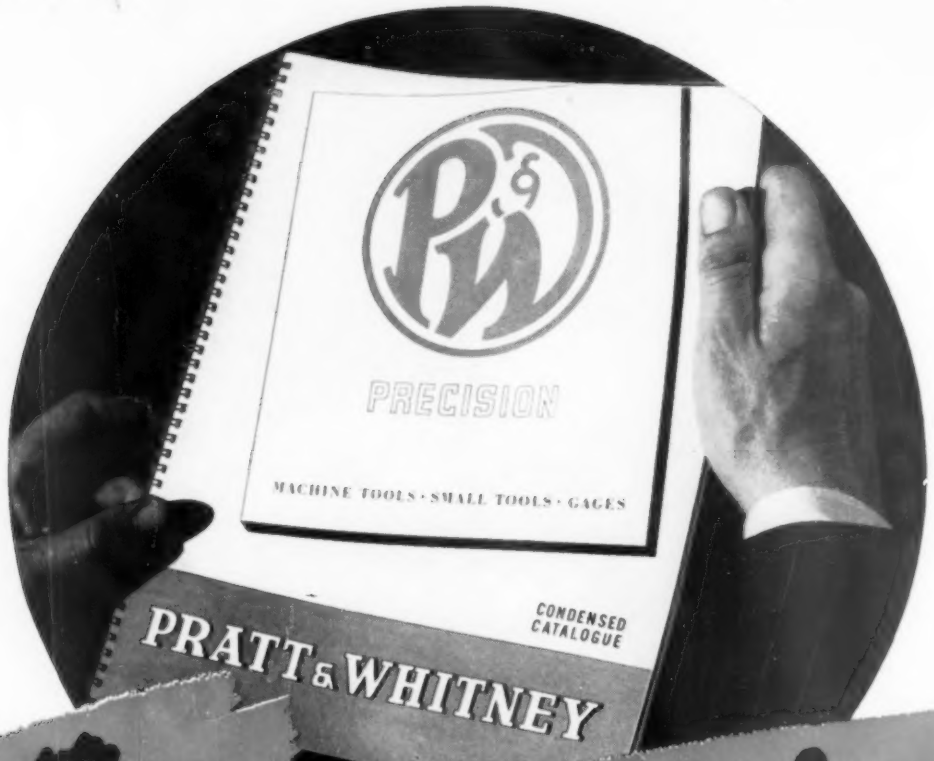

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VOLUME XV | OCTOBER, 1945 | NUMBER 3

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American Society of Tool Engineers

National Headquarters

1666 Penobscot Bldg. Detroit 26, Michigan

The TOOL ENGINEER
Editorial and Advertising Offices:
550 W. Lafayette Blvd. Detroit 26, Michigan

The Tool Engineer is published monthly at 1666 Penobscot Building, Detroit 26, Michigan, in the interest of the members of the American Society of Tool Engineers. Advertising and Editorial departments are located at 550 W. Lafayette Blvd., Detroit 26, Michigan. Subscription is $2.00 per year. Non-members $6.00 per year in the U.S.A., Canada, $6.50 per year; all other foreign countries, $8.00 per year. Copyright 1945 by the American Society of Tool Engineers. Entered as second-class matter February 8, 1945, at the post office at Detroit, Michigan, under the Act of March, 1879.

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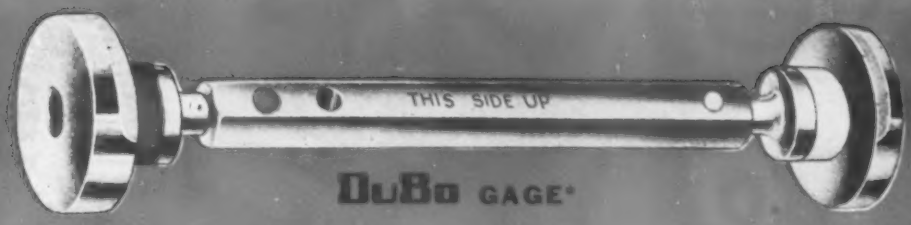

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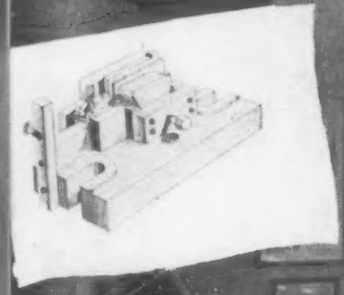

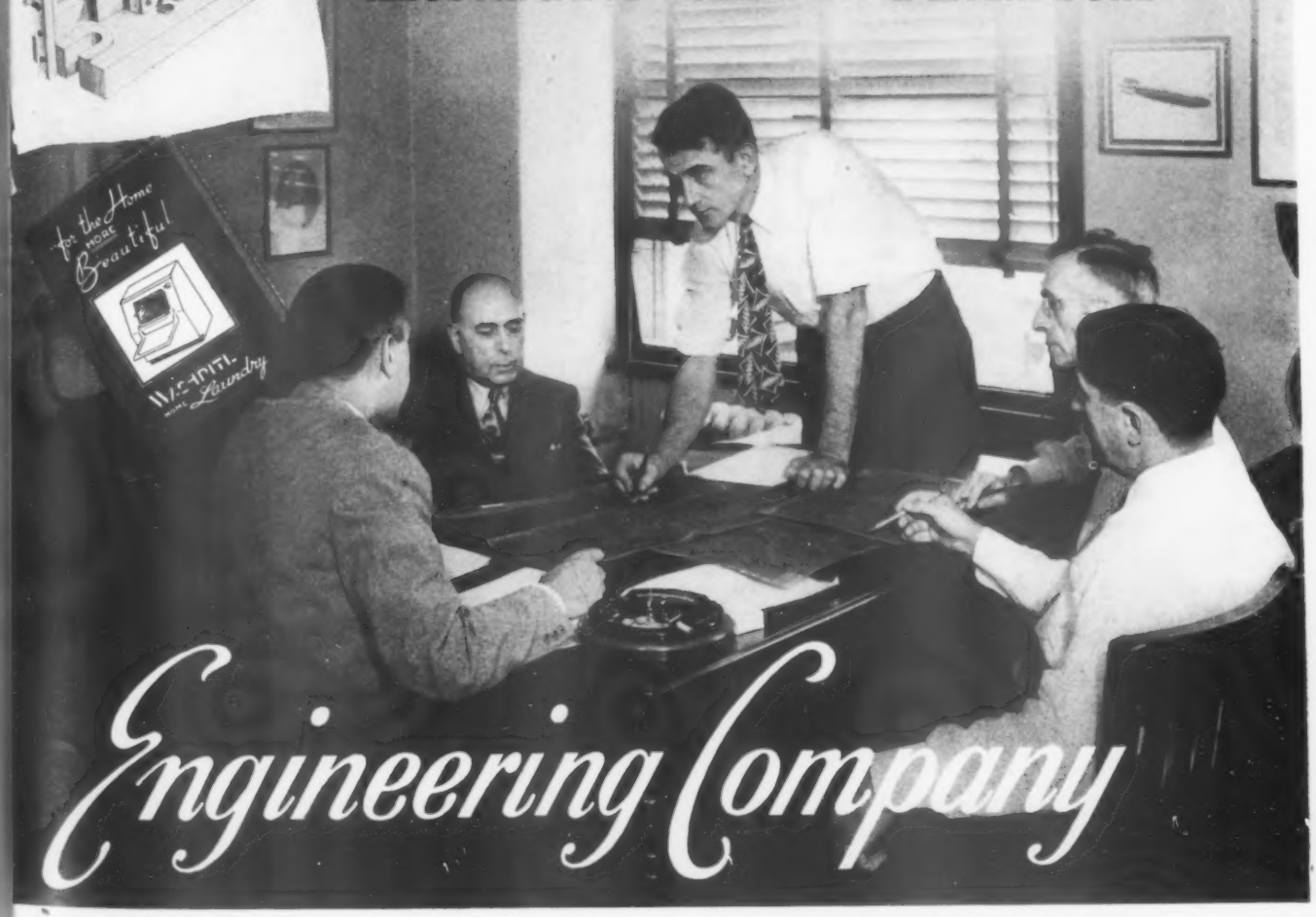

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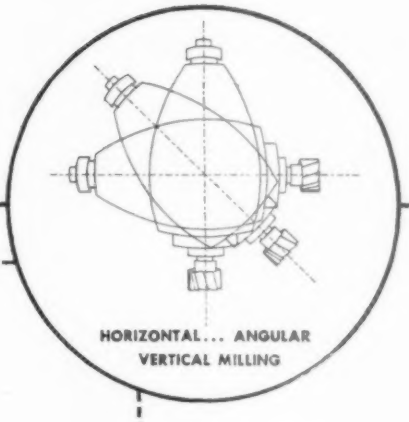

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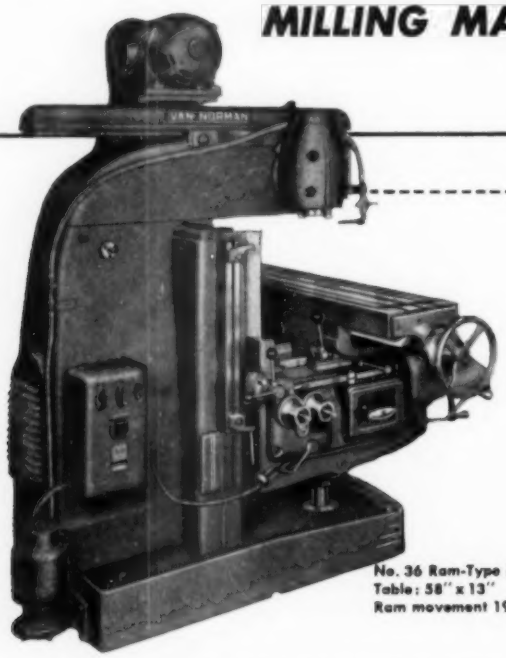

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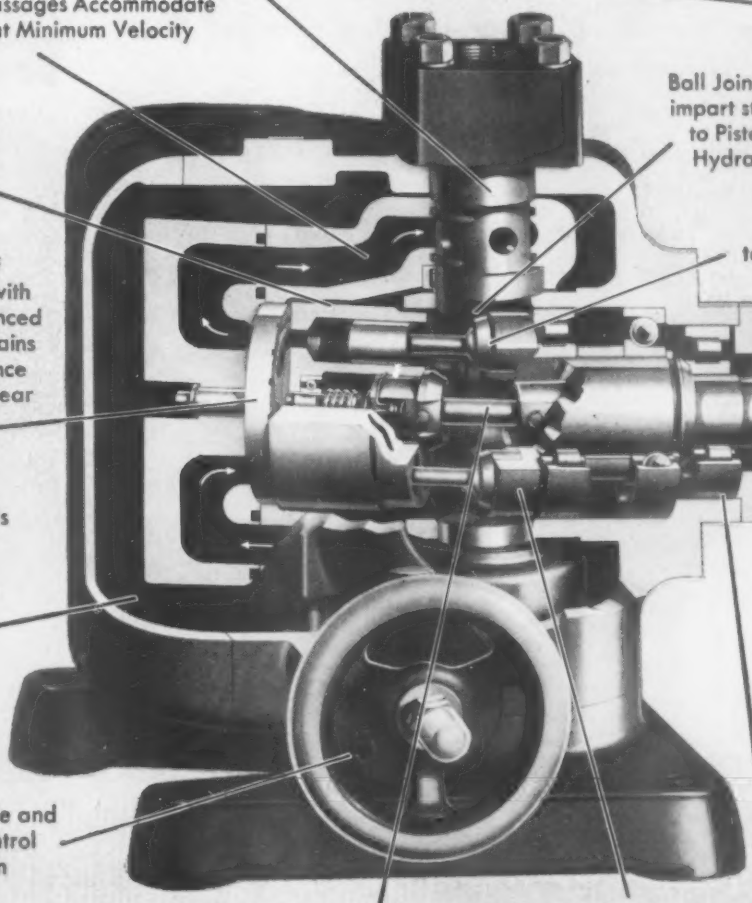
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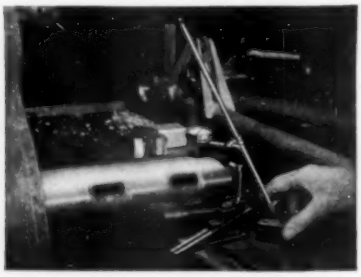

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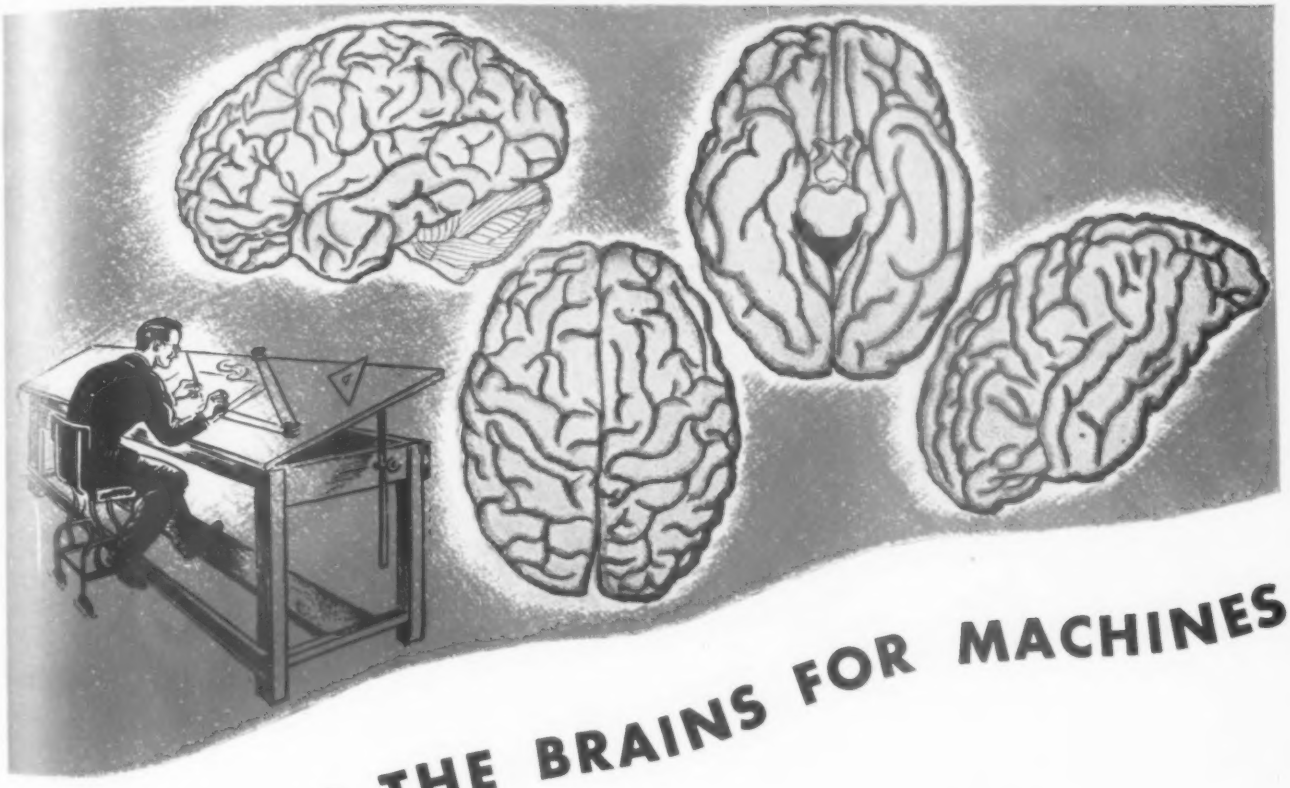

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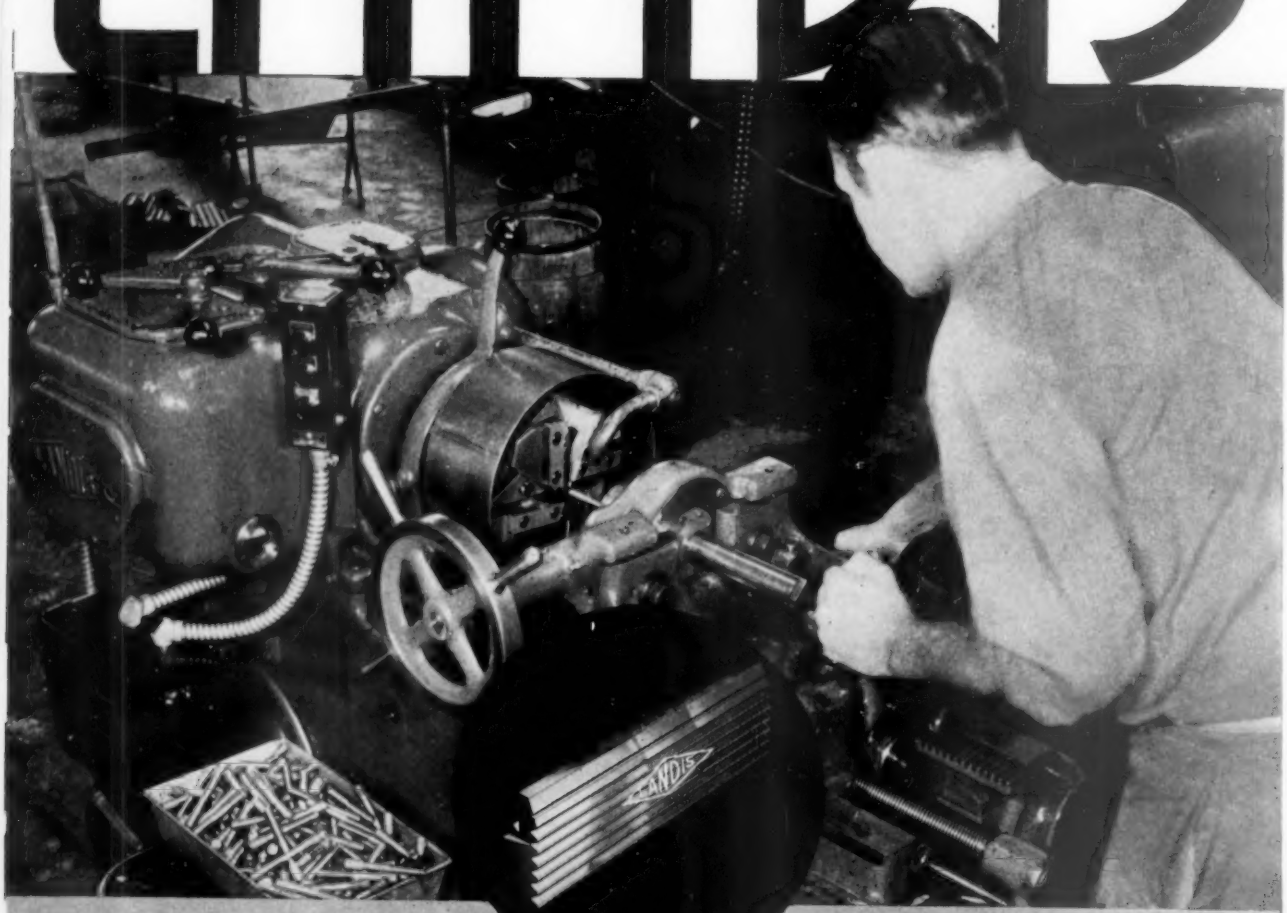

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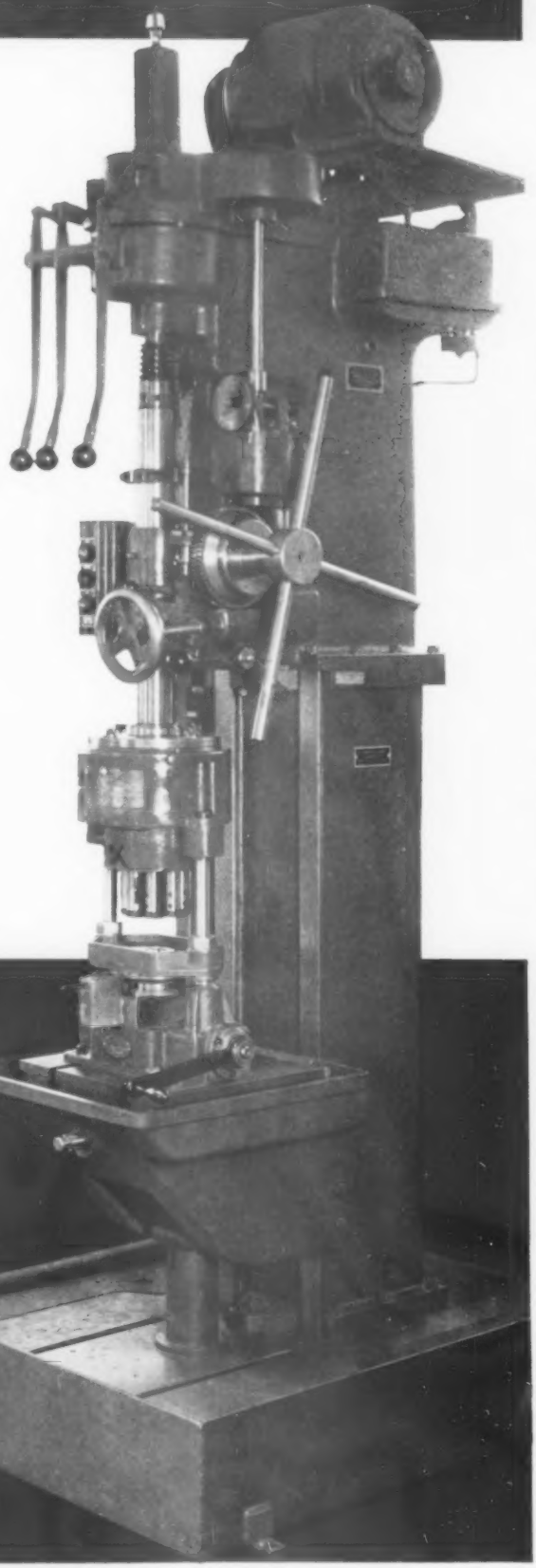

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"—and Pass the Information"

IT IS inevitable, when an organization grows as rapidly as has the ASTE in recent years, that difficulties are at times experienced in maintaining a continuously close relationship and understanding among the many Chapters, betwen Chapters and National headquarters, and between individual Members and National Officers.

Effective functioning of any democratic organization such as the ASTE is based on the dissemination of "information": Information as to who is doing or is supposed to do what, how and when; information as to new developments in Society affairs, local or national; information relating to individual members and their activities in connection with the Society.

Obviously,—since National Headquarters is the basic clearing house for all "information" relating to Society affairs—the focal point for cementing and maintaining a close relationship among Chapters and between Chapters and the National organization is "National Headquarters."

The job it has done in the past is quite remarkable when the tremendously rapid growth of the Society is taken into account with its inevitable effect of repeatedly rendering obsolete the frequently revised and re-revised (in an effort to keep pace with ASTE growth) mechanics for distribution of needed information.

A study of the entire headquarters operation some time ago, however, revealed that revision was again necessary. It was decided, moreover, that a complete modernizing of methods at National headquarters would be preferable to a further revamping of existing methods.

Assumption of direct publication of the "Tool Engineer" by the ASTE was a big first step. The incorporation in the magazine of an extensive news section devoted to Chapter activities and individual members was one of the most important results.

Meanwhile, National Headquarters was undergoing what amounted to a virtual revolution. Accounting was streamlined to make it possible, for instance, for Chapters to receive dues allocation checks on the 15th of each month. This meant that Chapters would know where they stood financially at any time. A new member-record system was installed so that each Chapter could be kept continuously informed as to the status, standing, etc., of its own members.

Facilities and personnel were provided so that it became possible to answer every request for information within a maximum of 36 hours. The process is still going on but it is not difficult to recognize already in these mechanical improvements the foundation for a better and closer understanding within the ASTE. For example, take the matter of ASTE Data Sheets. What had appeared to some members to have devolved into a rather haphazard enterprise under the sole sponsorship of "headquarters" has been put into an easily understandable operation on a Society-wide basis. Chapter Standards Committees now play a vital part in this work, since these Committees have the prime authority and responsibility in following through on all data sheets emanating from companies in their areas.

Yet this logical approach to the problem would not have been feasible without the proper mechanics for distribution of "information" from headquarters to everyone concerned. The improvement here is typical of what has already been accomplished in many other directions and will continue to take place in many other fields of activities within the ASTE. Out of all this is growing a stronger, more closely knit more effectively functioning, yet an even more democratically operated A.S.T.E.

C. V. BRINER,
President, 1945–46

By Martin A. Erickson

Experimental Stress Analysis Improves Design

New Approaches, Breaking with Traditional Methods of Design, Result in Greater Structural Strength with Less Material.

THE demand, of this age of mechanization in which we find ourselves, is for greater improvements in the design of machine parts. These improvements consist of securing greater structural strength by using a minimum amount of material, with demand intensified as a result of highly competitive markets for modern machinery. Especially, machinery which is within the buying power of the average citizen. In the past, due to lack of metallurgical control and stress measuring and testing equipment, the designer was compelled to rely on experience and mathematical calculations for the development of new designs. The uncertainties encountered from such an approach necessitated a substantial safety factor. As a result, many machine parts were overdesigned and, when failures occured in service, more material was generally added in the region of failure.

Martin A. Erickson was born in Seattle. Moving to Scandia, Alberta, he studied engineering at U. of Alberta, Edmonton, and at Queen's University, Kingston, Ont., from which he was graduated with honors. Queen's U. also conferred the Governor General's Medal and the M.E. Medal. Joining Chrysler Corporation in '36, he took 2 years P.G. at Chrysler Inst. of Eng'g., being graduated Master in M.E. Has since been engaged in Stress Analysis work at Chrysler Mechanical Laboratory.

Such a procedure may be justified when machines are produced on a small scale, or when successful operation depends on structural rigidity. In the majority of cases, however, as in the mass production of automobiles and household appliances, or where maximum pay load is demanded in ratio of weight of carrier—as in airplanes— weight saving is of prime importance. In order to meet these demands, traditional methods of design are usually inadequate. Newer approaches, based on more accurate determination of stress and fatigue strength evaluation, are necessary.

With the gradual advance in the sciences of metallurgy and stress analysis, in recent years, it has been possible to reduce the weight in machine parts and, at the same time, to maintain the necessary strength. With lighter weight parts, higher operating speeds have been possible and, consequently, greater outputs have been attained. A typical example of the progress made is illustrated by the Liberty engine of World War I, with a weight of 3.4 lbs. per horsepower, against an aircraft engine of similar capacity, today, with a ratio of 1.9 lb. per horsepower. The purpose of this paper is to show the part played by the science of stress analysis in attaining better design, and this will be done by describing the techniques used and applying them to practical problems.

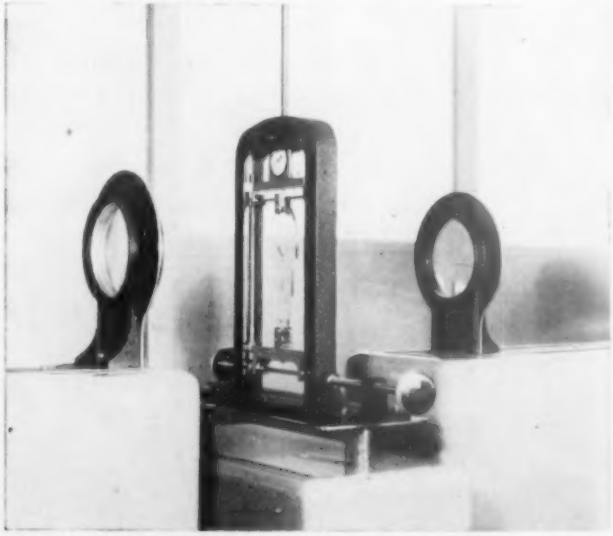
Types of Problems Confronting the Stress Analyst

The problems of the stress analyst begin with the origin of the design and are completed when the part has given satisfactory service life. The stress analyst is responsible for the structural strength of the design. He must obtain this strength, in most cases, with a minimum amount of material in order to produce a design of maximum effiiciency and economy. His work can be divided into two broad classifications, namely: (1) Design or Blueprint Stage, (2) Service Testing Stage.

The first classification begins at the drafting board, where sketches and preliminary layouts are made of the new design prior to the layout drawing. During this phase of the work, many theoretical stress calculations may be made in order to

FIG. 1. Polariscope used in Chrysler Laboratories.

FIG. 2. A plastic model in a universal loading frame placed in the field of the collimated beam.



determine the approximate dimensions of the sections required to withstand the computed service loads. Complicated sections, which do not lend themselves to theoretical calculations, can frequently be stress analyzed by experimental methods as follows:

(a) When the section to be analyzed has, mainly, a two dimensional stress system applied to it, such as fillets in a round shaft, or a hole in a flat plate, a stress measuring method known as photoelasticity is generally used. (This method will be described later in this paper). A general application of the use of photo-elasticity, in the early evaluation of a design, is given by an example of the problem to determine the strongest flange or thread fillet which will fit into a given space. In such a case, various two dimensional plastic models are made up and analyzed under the same load. The best fillet—i.e., the one showing the lowest stress—is then selected for the proposed design. This method of stress analysis is best suited to problems involving fillets, holes, press fitted joints, keyways and splines.

(b) When the section cannot be satisfactorily studied by a two dimensional analysis, it is frequently possible to cast up a plastic model of the design for stress analysis. This model is made up from a Plaster of Paris mold which can usually be constructed from a wood or brass pattern. If the proper technique is used in making the model, only a very small amount of machining and finishing is necessary. The finished model is then mounted in a suitable loading frame and analyzed by experimental methods which are discussed in the next section of this paper.

(c) When the part cannot be conveniently stress analyzed by the above methods, it is usually necessary to have the experimental part made up before a stress analysis is made. The procedure used in the analysis is then the same as described in section "b" above.

More Power for New Conditions

Quite often, a design may give satisfactory service life, but, competition may demand that more power be applied to the machine in order to increase the volume of production or, possibly, more power may have to be delivered in order to meet new service conditions. Experimental stress analysis is often useful in solving this type of problem. The loads and service conditions are fairly well established from past experiences and, with this information, it is then possible to develop the new design by comparison. The previous standard parts are stress analyzed along with the experimental part, under similar test conditions, and the results of the analysis indicate the relative strength of the various designs.

The second classification, of the work of the stress analyst, is service testing. When the experimental parts have been made, it is necessary to test their performance in the new machine. If failure of the part occurs, it then becomes necessary for the stress analyst to determine the cause and to make the necessary design modifications. This phase of the development can often be advantageously supplemented by fatigue tests of the part in a laboratory fatigue machine. These tests would be set up to duplicate service loads as closely as possible. Fatigue data obtained under these conditions are particularly useful in evaluating material properties.

Analysis of Past Failures

In addition to the development of new parts, the stress analyst is often called upon to analyze failures on parts which were developed in the past. In most cases no stress data is available and, therefore, it behooves the analyst to make a study of the cause of failure. In making this study, it is helpful to collect service data such as the percentage of failures out of the total production and also, if possible, to ascertain the average life of the part. This information will serve as a guide in determining whether the failure is due to fatigue or merely occurs, sporadically, as a result of material flaws or unusual load applications.

FIG. 4. Left, section through thread showing regions of actual failure.

FIG. 5. Right, plastic model assembled in loading frame.

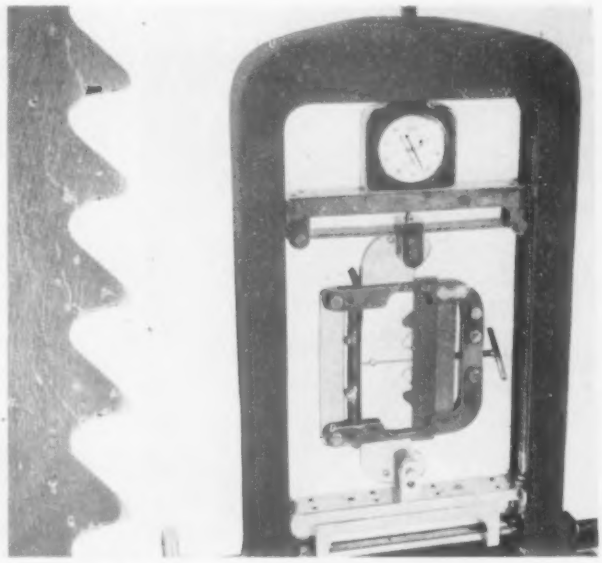


FIG. 3. Equipment used to prepare the plastic model.

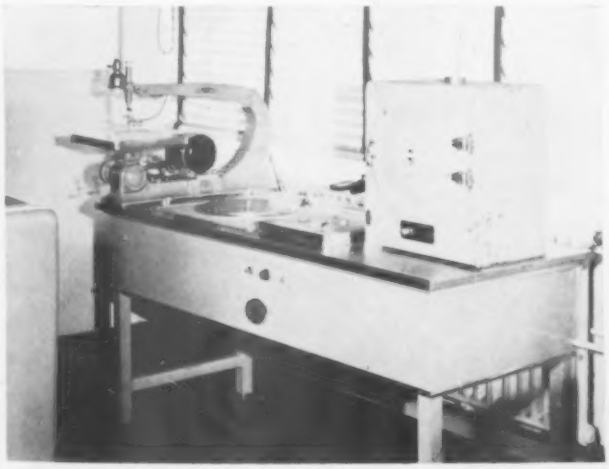
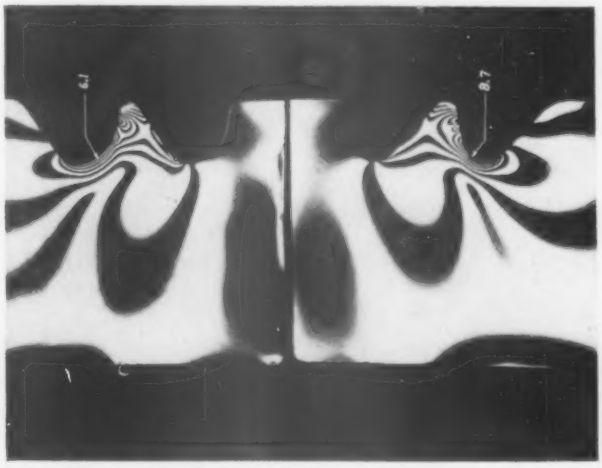


FIG. 6. Photoelastic fringe pattern of loaded thread model.



The next step, in the study, is to examine the fracture in the failed part. From this, it is usually possible to determine the nature of the load causing failure. The material in the fracture must also be studied for hardness, possible flaws, grain structure and grain orientation, although this latter phase of the study is usually made by the metallurgist.

Following such study, the nature and magnitude of loads must be estimated (measured if possible) in order to perform a stfess analysis. Whenever possible, the stresses are determined by calculations; however, if this is not sufficiently accurate the analysis must be supplemented by experimental methods. From this data, together with material specifications, it is usually possible to determine the cause of failure and to suggest a remedy.

Technique and Application of Experimental Stress Analysis*

There are at present four important methods of stress measurement available to the stress analyst. These are: (1) Photoelasticity; (2) Stresscoat; (3) Strain Gages and (4) Extensometers. The technique used depends largely upon the accuracy of the measurements required and the accessibility of its application to the part. Frequently, more than one method of measurement is necessary if accuracy is required in stress analysis of a part. A description of the various techniques and applications of stress measurements on a few typical machine parts is given below:

A. Photoelasticity.

Photoelasticity is the science of measuring stresses in an elastic body by optical means. This method consists of a study of the interference pattern produced when a plastic replica of the part to be studied is placed in the optical field of an instrument known as a polariscope. The polariscope used by the Chrysler Laboratories is shown in Fig. 1 and consists essentially of the following component parts:

(a) Polarizing Stage, (b) Field Condensing Lenses and Loading Frame, and (c) Analyzing Stage.

The function of the polarizing stage is to supply polarized light and to direct the rays of light in such a manner that they can be utilized for the stress analysis. This stage is composed of a light source (mercury arc), condensing lenses, a Wratten filter, a Clan-Thompson polarizing prism and a quarter wave plate.

The function of the second part of the instrument, composed of the two condensing lenses and the loading frame (shown in Fig. 2), is to control the passage of polarized light through the model which is strained by the loading frame. The condensing lenses provides a field of parallel light seven inches in diameter, while the loading frame serves to strain the model and position it in the optical field.

The function of the analyzing stage is to receive the impinging light rays passing through the model, analyzing them by a filtering process and projecting the resultant interference pattern on the ground glass or photographic film of the camera. This stage is composed of a quarter wave plate, a Glan-Thompson polarizing prism (both similar to that used in the polarizing stage), a photographic projection lens, two telescopic magnifying lenses mounted on a turret and an 8" x 10" camera. A first surface mirror is mounted behind the camera for the twofold purpose of visual examination and for focusing the photoelastic fringe pattern on the camera ground glass.

The stresses in the model under study are calculated from the fringe pattern. Should it be necessary to know the actual stresses in the metal part, a conversion can be made on the basis of the elastic modulis of the two materials (plastic and metal). As a rule, however, one may neglect the actual stress values and merely use the fringe pattern data as a guide in redistributing the material in the actual part to give the best stress distribution.

In conducting a photoelastic test, once the section to be analyzed has been selected, it is necessary to manufacture the model from a suitable plastic material. The material selected depends upon several factors as follows:

(1) The fringe constant; (2) the machining qualities; (3) the creep and strength characteristics; (4) the availability; (5) the residual strain condition; (6) the degree of polish and (7) the cost.

The materials most commonly used are Bakelite BT-61-893, Catalin, Marblette, and Columbia Resin CR-39.

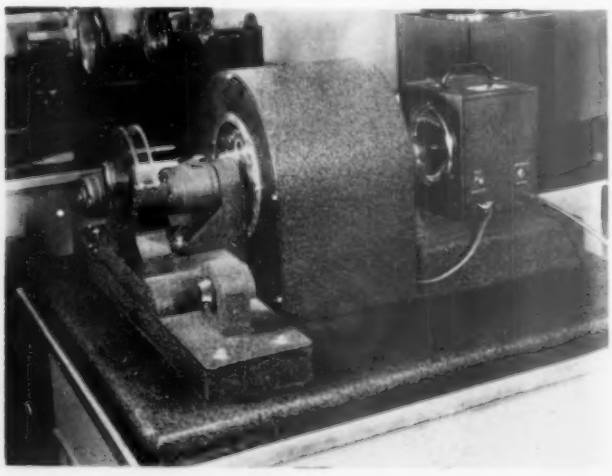
In making up the model a material of suitable thickness is selected. In most cases either ⅛", 3/16 in. or ¼ in. thick sheets are used, depending upon the size of the model. A metal template, accurately made, is then bolted or cemented to the sheet of material which is covered on both sides with adhesive paper to guard against scratches which may result from machining and handling.

The model is then carefully sawed out, to within 1/16 in. of the template edge, on a scroll saw similar to that shown on the Sample Preparation Table in Fig. 3. Following this operation, the model can be finish machined on the vertical mill (as shown in Fig. 3), using specially designed steel cutters for plastic work. A polishing machine and annealing oven are also shown on the Sample Preparation Table.

** Some of the applications used in this section are taken from the paper "Methods of Stress Determination in Engine Parts"—C. Lipson. S.A.E. Journal, April, 1943.*

FIG. 7. Photoelastic fringe pattern of loaded gears.

FIG. 8. Set-up for studying centrifugal stresses using a conventional polariscope.



(1) An application of the photoelastic technique to engineering problems is provided by an aluminum flange thread screwed onto a steel tube. (2) Due to the axial type loading, a buttress thread form was used. The purpose of this investigation was to prevent failure by developing a thread form showing considerable improvement over the existing design. (3) Under a tensile load, between the two members, failure in the aluminum occurred at the root of the thread fillet. See Fig. 4. In the course of the investigation 9 thread forms—as shown by Diagram A—were tested by means of photoelasticity.

Fig. 5 shows the method of loading the model. It will be noticed that a side loading is used to keep the thread models in contact. This side load fixture makes use of a plastic beam with a two point loading which, when subjected to load, will register a fringe pattern from which the magnitude of side loading is obtained. The specimen in this test was made from Catalin with a modulus of elasticity of approximately Ec=300,000 p.s.i. while the opaque plastic shown was made out of laminated Bakelite with a modulus of approximately Eb=1,000,000 p.s.i.

The purpose of this selection was to make an assembly which had the same modulus ratio as aluminum to steel, and to obtain rigidities comparable to service conditions. A typical fringe pattern, obtained from this study, is shown in Fig. 6. The right hand portion shows the original design while the left hand portion shows the experimental design tested.

The results of the investigation are shown in Table 1. All of the experimental designs were based upon design No. 1, which was used as a standard for comparison. Contact stresses between the thread engaging surfaces exceeded the thread fillet stresses in all cases. The former, however, are compressive stresses, while the latter are tensile and, since failure occurred in the fillets, these latter stresses were considered critical and consequently had to be decreased. From the results, design No. 3 was selected as the best thread form for the required application. This selection was made on the basis of ease of manufacture, which outweighed the advantage of lower stress found in other designs. Service tests indicated that this design was adequate from the standpoint of strength.

No.	Description	R_1 (in.)	R_2 (in.)	D (in.)	STRESS Values — p.s.i. Contact	Fillet	% Improvement Contact	Fillet	LOAD APPLIED Axial (lbs.)	Thrust (lbs.)
1	DESIGN No. 1	.034	.016	.903	1950	1520	0	0	65	5
2	DESIGN No. 2	.029	.013	.075	1870	1530	4.1	-.07	65	5
3	DESIGN No. 3	.046	.025	.0714	1530	1350	21.5	11.2	65	5
4	DESIGN No. 4	.075	.025	.040	2120	1190	-8.7	22.4	65	30
5	DESIGN No. 5	.029 .063	.019	.082	1690	1510	13.3	0.1	65	5
6	DESIGN No. 6	.052	.018	.082	1790	1330	8.7	12.5	65	30
7	DESIGN No. 7	.0173 .0617	.007	.103	1350	1170	30.8	23.0	65	5
8	DESIGN No. 8	.0173 .0617	.014	.0900	1350	1170	30.8	23.0	65	5
9	DESIGN No. 9	.0443	.022	.0796	2370	1190	-21.5	21.7	65	30

Table 1: Stress analysis of various thread forms.

The problem solved above is very similar, in many respects, to that encountered in cutting tools such as broaches, cutters, reamers, band saws and similar. In these tools, stress concentrations also exist at the fillets. For example, band saws that are resharpened are frequently left with sharp fillets which become local points of failure under operation. Production broaches and cutters must also have properly shaped and finished fillets if they are to withstand service conditions. The tool designer, however, has been very fortunate in the tools he has developed due to the fact that, while rounding the fillets in his tools so that chips may slide off correctly, he has of necessity made generous fillets which reduced the magnitude of stress concentration. In spite of this, problems do exist in service where a study of the stress in the fillets would prove beneficial.

STRESS ANALYSIS OF VARIOUS THREAD FORMS
ALL THREADS REDUCED TO 6-PITCH
30 × SIZE

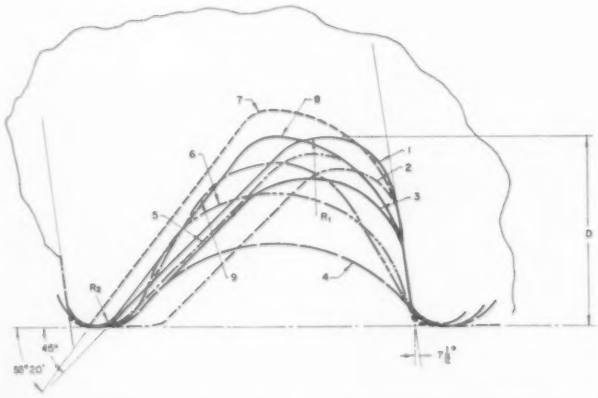


Diagram A:- Stress analysis of various thread forms. All threads reduced to a pitch and shown enlarged about 12 diameters.

FIG. 9. Set-up for studying centrifugal stresses based upon the behavior of plastics at elevated temperatures.

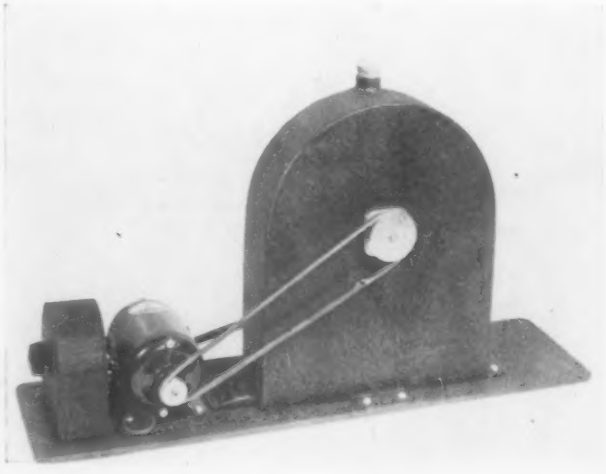
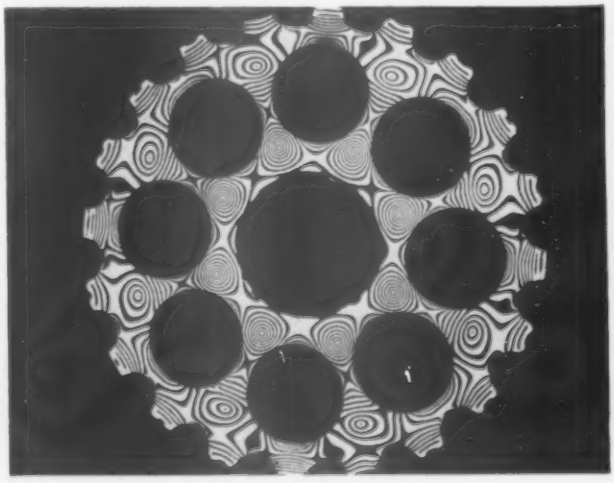


FIG. 10. Effect of lightening holes on the stress distribution in a high speed rotor.



Another typical example of a stress problem applicable to photoelasticity is the study of stress concentration produced by lightening holes in a bull gear of a large machine. (See Fig. 7). From the count of the fringes and a calculation of the forces at the section studied it was concluded that the stresses produced by the lightening holes were not excessive.

Still further applications of the photoelstic techniques are made in the study of dynamic stresses in vibrating plastic beams of centrifugal stresses, as in rotors. This is accomplished by operating the part under the required dynamic loading, using a stroboscopic light source synchronized with the motion of the model, thus—in effect—freezing the pattern which then allows the fringe pattern to be photographed. For an illustration of this technique see Fig. 8, in which a plastic rotor is made to rotate in a protective housing by means of a small electric motor. A contactor on the motor shaft flashes the strobotac which sends a beam of light through the polarizing lenses, thus permitting an observation of the fringe pattern at the open end of the instrument. Similar setups could be made up for the study of other moving parts.

Another method for studying centrifugal stresses is by means of a principle based on the behaviour of plastics at elevated temperatures. Above a certain temperature, the plastic model yields and the external force impressed upon it is relieved by the deflection of the material. On subsequent cooling, the model will retain the impressed deflections and will exhibit a stress pattern.

A typical problem, using this method, is provided by a supercharger rotor stress analysis. A plastic rotor representing the supercharger rotor section was made up and rotated in an oven at 2,300 r.p.m. at 180° F. for one hour. (See Fig. 9). On subsequent cooling, with the model still rotating, a fringe pattern (Fig. 10) was obtained when the plastic model was examined in the polariscope. A study of the resulting stresses indicated that the maximum stress occurred at the edges of the lightening holes.

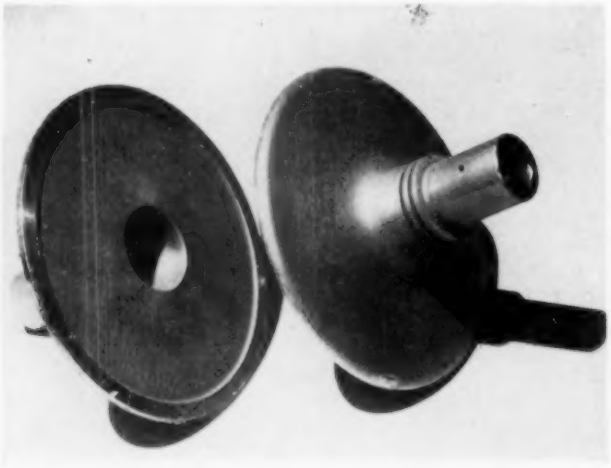
In the foregoing examples, the photoelastic study was made on flat or two dimensional models since the problems involved were principally of a two dimensional nature. There are, however, many cases where a part to be studied has a three dimensional stress distribution which cannot be handled by the above technique. Problems of this type occur in connecting rods, pistons, crankshafts with hollow journals and pressure vessels.

There are photoelastic techniques available for the study of stresses in three dimensions, in plastic models, but as yet no general use has been made due to the difficulties encountered and the limited accuracy attainable by these techniques. The majority of three dimensional stress problems are solved today by other methods, some of which are discussed below.

B. Stresscoat

Stresscoat is a brittle lacquer which is used for the purpose of indicating the strain pattern in loaded parts. This lacquer fractures under a relatively low value of tension strain, the direction of fracture occurring at right angles to the direction of strain indicated. Stresscoat is used to indicate the location, direction and magnitude of the strains in the parts to which it is applied.

While the Stresscoat fractures under tension strain only, it can also be used to indicate compression by maintaining the compression load on the part for several hours until



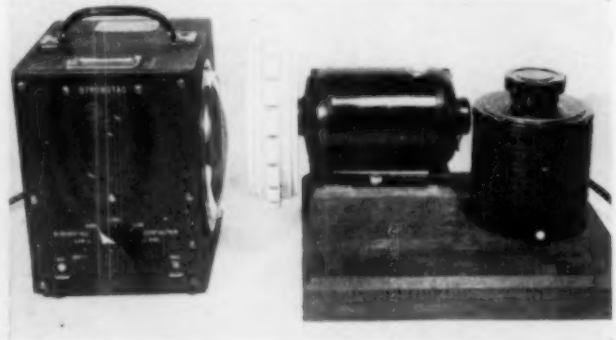


FIG. 11. Stresscoat pattern of assembly end plates.
FIG. 12. Below. Set-up for determining the stresses in a high speed rotor by means of Stresscoat.
FIG. 13. Upper right. Cracks, in Stresscoat coating, indicate stresses set up due to centrifugal forces.
FIG. 14. Lower right. Application of electrical strain geges to investigation of a cylinder block.

the lacquer has normalized itself by plastic flow and then releasing the load. The fractures which appear are due to tension in the lacquer, but, since the compression was relieved the indication given by the lacquer is a measure of compression strain in the part under test.

Stresscoat is generally used for static tests although it can also be applied to a few limited dynamic tests where the temperature or humidity remains unchanged throughout the test. The technique consists of first spraying an undercoat of aluminum paint on the cleaned surface of the part followed by a coat of Stresscoat. The undercoat serves as a reflecting surface for the observation of the fractures. Several steel bars, ¼" x 1" x 10" long, are generally sprayed at the same time and in a similar manner to the part, for calibration purposes.

After a drying period of from 6 to 12 hours the part is loaded and the observations made. Calibration bars, loaded in a specially designed fixture supplied with the Stresscoat equipment—a product of the Magnaflux Corporation—are used to determine the strain constant of the lacquer. With this information, it is possible to determine the magnitude of strain of the part tested as the fracture of the lacquer occurs. The stress is obtained by multiplying the observed strain by the elastic modulus of the material tested.

A typical application of the Stresscoat technique, to a structural problem, is the stress investigation of an assembly consisting of a series of discs held together by means of an axial bolt through two steel end plates. The problem was to determine the stress distribution on the end plates due to axial load. The end plates were Stresscoated and assembled prior to loading, and were then loaded in the Olsen machine by means of suitable fixtures.

The pattern obtained is shown in Fig. 11, the member on the left showing the tensile stress distribution while that on the right shows the compressive stress distribution. The maximum tensile stress which was considered most critical was located in the sharp corner at the base of the counterbore. The stress at this point was 95,000 p.s.i. which exceeded the yield point of the material (85,000 p.s.i.). Since the maximum stress is highly localized and the loading in this case principally static in nature, failure may be averted.

Another application of Stresscoat is made on a high speed rotor where the principle loading is centrifugal (essentially static). The problem was to compare two proposed designs, one having a thicker rim section than the other, on the basis of strength. The test was conducted by Stresscoating two rotor models made out of plastic and rotating them at various speeds in fixture (Fig. 12) until fracture of the lacquer occurred. See Fig. 13. The results indicated that the highest stresses occurred radially in the fillet joining the web with the rim (Diagram B) and also, that the rotor with the thin rim was stressed 20 to 25% lower than the heavier rotor. The decrease in stress was in proportion to the thickness of the rim section.

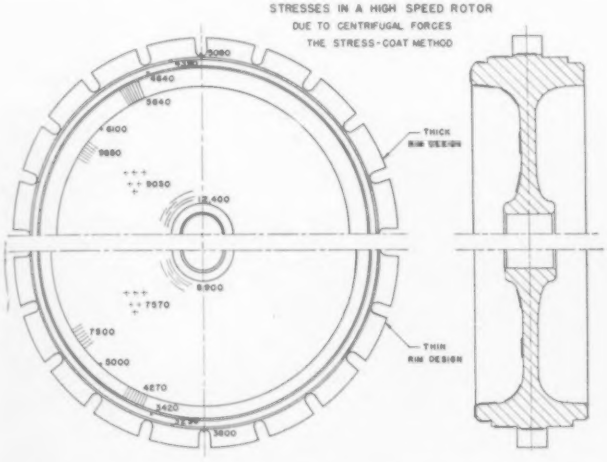
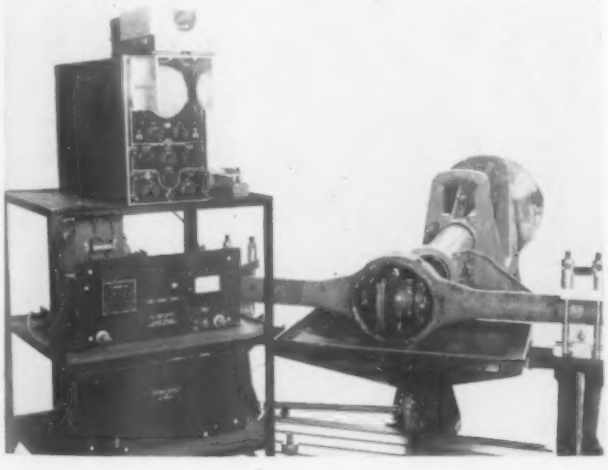


Diagram B:- Stresses in a high speed rotor due to centrifugal forces. Stresscoat method.

FIG. 15. Set-up showing the instrumentation used and methods of loading the differential case in the four-square dynamometer.



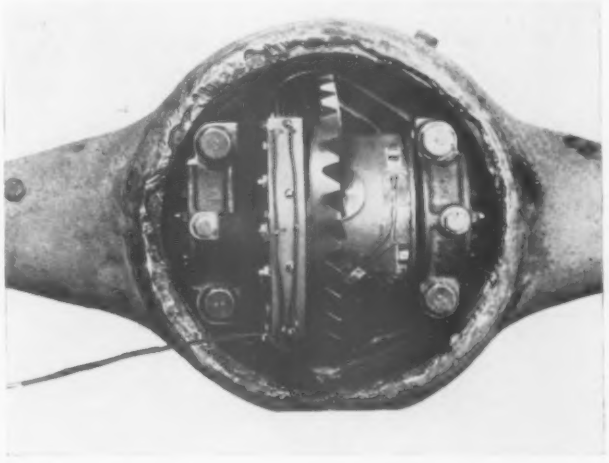
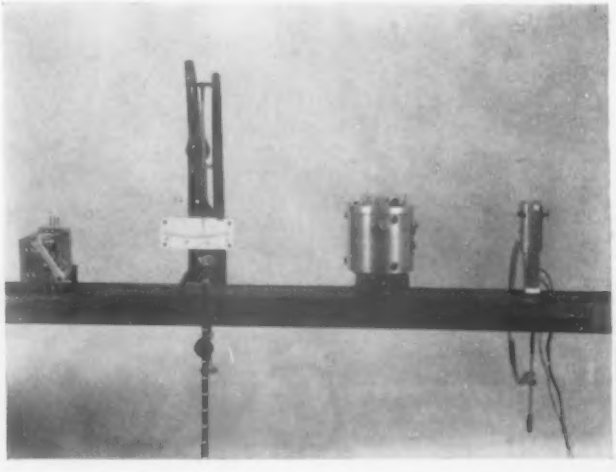


FIG. 16. A closeup view of the differential case showing strain gage location and slip ring assembly.

FIG. 17. Extensometers used in the Chrysler laboratories.

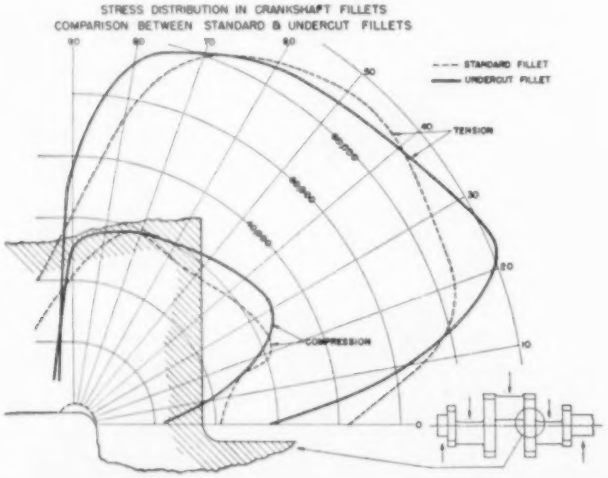


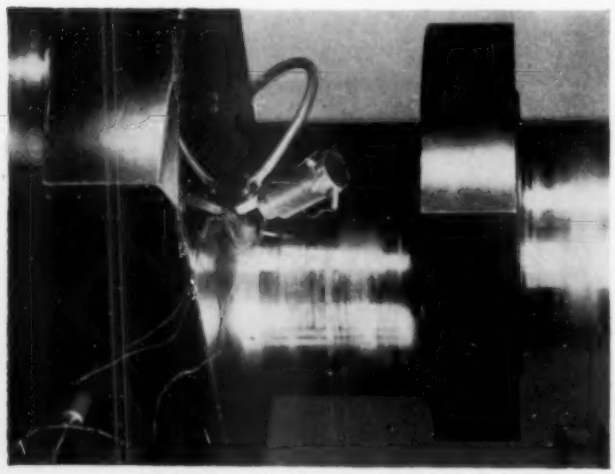
C. Electrical Strain Gages

The electrical strain gage is an electrical element in which a variation in average strain of the element is accompanied by a proportional change in its electrical or magnetic characteristics. There are four main types of electrical strain gages in use today, namely:- electromagnetic, piezoeelectric, carbon resistance and wire resistance. These gages are finding more and more applications in numerous laboratories and industrial organizations, especially the wire strain gage which works on the principle that the resistance of wire increases with tension and decreases with compression.

Electrical strain gages are generally used in stress analysis in the following instances: (1) Where greater accuracy is required than is obtained from Stresscoat or photoelasticity; (2) where other methods cannot be used, such as, for instance, in the shank of connecting rod bolts assembled in the connecting rod on the inside surface of a hydraulic system, and (3) for load calibration of parts. This technique consists of a static load calibration of a strain gage mounted on the part in a loading fixture and then comparing the gage data obtained on the part in service to the static calibration curve in order to obtain the service load. (4) For measuring the effect of section changes. In this application, the gage reading is taken on the original specimen and with the gage still mounted. Material is then added to or removed from the part when a second gage reading determines the effect of the section change. This procedure is repeated until the desired results are obtained. (5) Finally, for determining stresses in parts under service operation.

Diagram C:- **Stress distribution data in crankshaft fillets as obtained by the photoelectric extensometer.**





Electrical strain gages also play an important role in instrumentation which is beyond the scope of this paper. A description of the large variety of strain gage measurement and recording equipment is also too extensive to adequately discuss here.

A typical example of the use of wire strain gages is shown in the problem involving the comparison of two cylinder head designs as a function of cylinder head stud tightening. The machined face of the block was Stresscoated, load applied by tightening the studs, and the stress pattern obtained. Strain gages were then applied at right angles to the Stresscoat indications at the high stress regions located. (Fig. 14). The load was again applied, and the gages read, resulting in data which showed that, as a result of the water jacket change made in the one design, the stresses in the region of failure were decreased 30 per cent. Stresses resulting from various degrees of bolt tightening were also made in this study.

A typical dynamic problem, solved by means of electrical strain gages, is the truck differential case which failed in service due to the stress concentration at the large lubricating holes. A Stresscoat test, followed by an electrical strain gage test on the foursquare axle dynamometer, indicated that high fatigue stresses sufficient to cause failure were present near the large lubricating holes. A design modification on the case distributed the stresses more uniformly, eliminating the service failures. The test setup, including the rear axle mounted in the dynamometer, and the electrical strain gage instrumentation is shown in Fig. 15. A detailed view of the strain gage locations and method of wiring through the use fixture. (See Fig. 18 and Diagram C.)

D. Extensometers

The extensometer is an instrument used accurately to measure changes in distance between two attachment points, the initial distance between these points being known as the gage length. For stress analysis, gage lengths of ¼ in. or less are most commonly used. There are many types of extensometers in use today, of which several are shown in Fig. 17. They are, from left to right: (1) Maze Gage; (2) Huggenberger extensometer; (3) Tensor gage and (4) Photoelectric extensometer.

Of these extensometers, the photoelectric and the Huggenberger are mostly used in the stress analysis of machine parts where short gage lengths are required. The Maze and Tensor gages are used mainly in the stress analysis of sheet metal parts.

A typical problem in which the photoelectric extensometer played a major part was that of a crankshaft failure. The investigation was undertaken to determine if the failure could have been due to poor design. Careful stress traverses were measured through the crankpin and main journal fillets of a broken portion of the crankshaft attached to a fixture. (See Fig. 18 and Diagram C).

FIG. 18. **Left. Photoelectric extensometer mounted to the crankshaft fillets.**
FIG. 19. **Measuring strain on connecting rod.**

Bending loads were applied to the free end of the crankshaft, and the resultant stress data plotted on a Goodman diagram for several operating conditions. (See Diagram D). It will be observed that the stress range represented by the vertical lines must fall with the inner shaded lines if failure is not to take place. (Each of the vertical lines represents a separate point on the stress traverse). The results indicate that the stress range in the main journal fillet is greater than that permitted by the Goodman diagram and hence failure can be expected. A glance at the crankshaft section, shown in the lower right of Diagram D, readily substantiates the above findings and indicates a weakness in the design.

Extensometers, as a rule, give a high degree of accuracy when a gage length of the proper size is used. This instrument also permits the measurement of strain in more than one direction, thus enabling the operator to find the direction of maximum stress after a few trials. On the other hand, extensometers are difficult to handle and require a great deal of patience on the part of the operator.

Residual Stresses:*

The technique described in the foregoing section applies only to the measurement of stress due to external loading of the part. There are also stresses present in many parts without the application of external loads. These stresses are known as trapped, locked-up or residual stresses. They are created by manufacturing operations, such as casting and subsequent cooling, forging, welding, quenching, hardening, straightening and surface cold working. Residual stresses, as they are most commonly called, can be destructive or beneficial, depending upon the nature of the stress (tensile or compressive) and also upon the external loading condition. Generally, a compressive stress at the surface will increase the fatigue life of a part while tensile stress will have a detrimental effect.

Residual stresses are measured by several different methods; however, most of them are destructive to the parts under test. Methods which are non-destructive are X-ray and photoelastic. The X-ray technique is limited to materials under 45 Rockwell C in hardness, while the photoelastic technique is limited to a few transparent materials. The destructive methods of residual stress measurement are mechanical, using the various stress measuring techniques for their evaluation. They are generally done by placing the strain measuring device on the region to be studied and then relieving the material under the device thus obtaining a strain reading from which the residual stress can be calculated.

An example of the latter technique is given by an automotive connecting rod forging, Fig. 19. Here, the measuring technique involved mounting electrical strain gages on the rod at the wrist pin end, on the pin end to shank fillet, on the shank and on the crank pin end to shank fillet, and then relieving the metal under these gages by sawing with a hack saw to within 1/16 in. of the gage.

The difference in strain gage reading, before and after sawing, gave the magnitude of residual strain removed. Since the metal under the gages was not completely removed, the residual stress measured was not the maximum present; however, the purpose of the test was merely to determine if existing stresses could explain the nature of failures obtained in push-pull fatigue tests.

In the fatigue testing of these rods, the majority of failures occurred in the wrist pin eye. Since the stress due to externally applied loads was relatively uniform throughout the wrist pin eye and shank sections of the rod (See Diagram E), there was no apparent reason why failure should occur in the pin eye. The residual stress study indicated, however, that a high resultant stress occurred at the small end of the rod, thus explaining the reason for failure. The stress data obtained from the externally applied load (operating stress) together with the residual and resultant stresses are plotted in Diagram E.

From this analysis, it is apparent that, in order to evaluate a design, it is not only necessary to know the stresses applied due to external loads, but the residual stresses present must also be known. However, it is not intended to leave the reader with the impression that design can be evaluated by complete knowledge of the stresses alone. This is only one phase in the development of the machine part.

**Reference is made here to the paper "Residual Stress Study" by R. W. Greaves, E. C. Kirstowky and C. Lipson delivered at the 1944 Fall Meeting of the Society for Experimental Stress Analysis.*

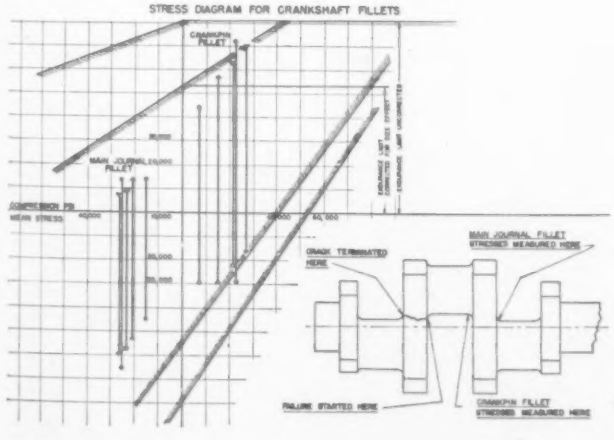

STRESS DIAGRAM FOR CRANKSHAFT FILLETS
CRANKPIN FILLET
MAIN JOURNAL FILLET
ENDURANCE LIMIT CORRECTED FOR SIZE EFFECT
ENDURANCE LIMIT UNCORRECTED
COMPRESSION PER MEAN STRESS
CRACK TERMINATED HERE
MAIN JOURNAL FILLET STRESSES MEASURED HERE
FAILURE STARTED HERE
CRANKPIN FILLET STRESSES MEASURED HERE

Diagram D:- Goodman stress diagram for the crankshaft fillets.

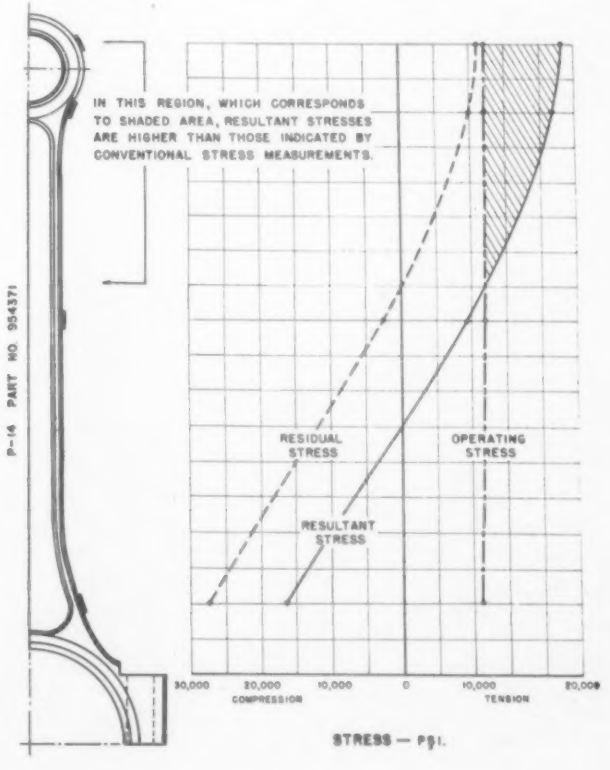


Diagram E:- Right. Effect of residual stresses on the strength of connecting rods.

Material factors and fatigue data must also be available before a prediction of service life can be made, and final evaluation cannot be made until the data from service testing has been secured. However, a discussion of material factors, fatigue and service testing is beyond the scope of this paper. Much information, on these subjects, is available in literature and textbooks.

Conclusion

An attempt has been made, in the foregoing sections, to describe the work of the stress analyst and some of the tools and techniques he has available for his studies. There still exist many limitations to the applications of experimental stress analysis to development work, such as an accurate knowledge of loads which can be expected on many designs, inability to measure stresses at temperatures above 400° F. and so on. Some of these limitations may be overcome in the near future, thus increasing the applications of the science of experimental stress analysis to many more problems.

In spite of imitations, however, the science has paid dividends through its application to design and the elimination of failures in many of the implements of war during the past four years. The outlook for still broader applications in the development of improved designs in the post war era appears even brighter.

By Albert W. McCalmont

Cutting Fluid Applications

The right cutting fluid, properly applied, prolongs tool life and improves surface quality.

The following recommendations, for application of cutting fluids, are in direct response to inquiries, by Tool Engineer readers, for further information on this subject.

Ed.

THE use of cutting fluids, particularly in machining steel and the more ductile metals, prolongs the life of the cutting tool and permits the work to be done at a higher speed. The following factors contribute to this.

Cooling:- The cutting or tearing of the metal generates heat, and with high-speed steel tools it is necessary to maintain a low enough temperature to allow the tool to retain its hardness and to resist wear. Moreover, cooling the chip makes it less ductile so that it breaks more easily, and is consequently carried away.

Lubrication:- The cutting fluid is so compounded that it will wet the metal readily. It lubricates the portion of the tool that bears against the chip. It also lubricates the part of the tool that supports the cutting edge.

Prevention of "pick-up":- Particularly with high speed steel tools that are cutting steel, microscopic particles of metal from the work weld to the tool and roughen it. This shortens the life of the tool and frequently spoils the finish. Cutting fluids may be so compounded that they will prevent this welding.

Chip Removal:- In addition to cooling the chip to make it break more easily, the cutting fluid or coolant serves to carry the chip away cleanly, and prevent accumulation.

Dimensions:- If the work is not properly cooled it may expand while it is being cut. When this happens the work will be too small when it is cool. The maintenance of a uniform temperature prevents this.

Finish:- When the tool is properly lubricated it will cut more smoothly and produce a better surface finish.

Mineral oil alone is used as a cutting fluid for some nonferrous metals. Mineral oil, when specially treated for that purpose, will emulsify with water, and since water is a better coolant than any kind of oil, emulsions of oil and water have general application. An oil that will emulsify with water is a soluble oil.

As an additive to the basic mineral oil, lard oil is very often used because it increases film strength. For many operations, with high-speed steel tools, sulphur is added to prevent pick-up of the metal from the work-piece to the tool. The activity of the sulphur can be controlled by the method of adding it. Added sulphur, which will blacken a copper strip in a specified time at a specified temperature, is called active sulphur. Sulphur which does not blacken the strip may be said to be inactive. In addition to the lard and sulphur, specially controlled chlorine is used with the harder cutting metals on the more severe operations.

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For convenience in application, cutting fluids may therefore be divided into several classes such as the following:

Lard, Active Sulphur and Chlorine, used on the hardest cutting steels for the most severe operations, and for thread grinding.

Lard and Active Sulphur used also on the most severe operations, and on the harder cutting steels for part of the others.

Lard and Inactive Sulphur used on all cutting operations for the easier cutting steels and on the less severe operations for the harder cutting steels.

Mineral Lard used principally on other metals than iron and steel.

Mineral Oil used for machining magnesium, and for a diluent.

Soluble Oil mixed with water and used principally as a coolant and for rust control, where little lubrication is required.

The most severe cutting operations are those which are done at relatively low speeds, and under heavy and somewhat intermittent loading. Examples are broaching, heavy threading, gear cutting and deep drilling. The least severe is the cutting that can be done at relatively high speeds, such as turning, boring, milling, shallow drilling and light threading. All of this is shown in the accompanying chart.

So that the most heavily compounded cutting fluids may be used on the most severe operations, and the lightly com-

pounded on the least severe, the operations have been arranged in the order of their severity. Finish cuts, with very low feeds, are not severe operations. The metals to be cut are grouped into "easier cutting" and "harder cutting" classifications. For the harder cutting metals, more heavily compounded cutting fluids are used, as a rule. The various types of steel are identified by numbers.

There are three basic types of material used in cutting tools, and the important difference in the metals is the temperature at which these will lose their hardness and cease to cut. High temperatures are caused by high cutting speeds where a greater amount of metal per minute is removed from the work, and a corresponding amount of heat generated.

High Speed Steel:- The first steels to be used for cutting tools were high carbon because at the time, these were the hardest. Later, when special alloys—which retained their hardness at higher temperatures—came into use, they were called high speed steel because they permitted higher cutting speeds. They are still widely used.

Cobalt Alloys:- Thirty years ago, the first cobalt alloy (which was Stellite) came into use because it retained its hardness at higher temperatures than the prevailing high speed steels and permitted higher cutting speeds on many operations. There are now other alloys of this type.

Cemented Carbides:- Within the last ten years cutting tools have been made, from tungsten carbide alloyed with cobalt, by the powdered metal and sintering process. This alloy retains its hardness at still higher temperature. These carbides are made in small blocks to various sizes for various cutting tools. They are cemented—or brazed—under high temperatures, to recesses cut in the steel shanks that carry them and the cutting is actually done by the small sintered carbide insert. With these various cutting tool materials different types of cutting fluid are often needed.

With any given tool material, therefore, it is desirable to apply the most heavily compounded cutting fluids to the most severe operations on the hardest materials. The least heavily compounded are by the same rule, applied to the least severe operations with the easier cutting metals.

In the cutting fluid chart, therefore, the operations have been arranged in the order of severity, and the steels divided into easier cutting and harder cutting groups. It will be noted, in the cutting fluid chart, that more than one cutting fluid is recommended under each operation for both the easier and harder cutting metals. The chart is based on manufacturers' practice, which is the only satisfactory basis for recommendations.

No one manufacturer uses all of these cutting fluids, but each has a definite advantage in some combination of operations and materials. The operator usually prefers to carry fewer grades, using a stronger fluid where a weaker one would be adequate. He can reduce the strength of a cutting fluid by diluting it with mineral oil of the correct viscosity. In emergency, he can even use a fluid that is not strong enough for high efficiency, by reducing the cutting speed or feed.

In offering the cutting fluid for the user's requirement, it is necessary to know whether he is basing his selection on the most effective fluid for the hardest operation, or how far he wants to go in accommodating it to other operations. If the hardest operation is a large production job he will probably want the most effective cutting fluid he can get. If, on the other hand, the hardest operation is infrequent, he may logically prefer a fluid of lower compounding. In general, where most of the machining operations are performed, at least three cutting fluids will be needed, as follows:

1. An oil compounded with lard oil and active sulphur, with or without chlorine, as requirements may indicate.

2. An oil compounded with lard and inactive sulphur for the lighter operations or where the machine tool may require it.

3. A soluble oil adapted to the kind of water used, for emulsions to be used usually on the lighter operations, and particularly with the harder cutting tool materials.

CUTTING FLUID RECOMMENDATIONS

ORDER OF SEVERITY	OPERATIONS	TOOL	FOR EASIER CUTTING IRON AND STEEL — TYPE OF COMPOUNDING	TOOL	FOR HARDER CUTTING IRON AND STEEL — TYPE OF COMPOUNDING
1, 2	Broaching and Pipe Threading	HS HS HS CC	Lard; Active Sulphur (H, M) Lard; Inactive Sulphur (H) Soluble Oil and Water Soluble Oil and Water	HS HS CC CC	Lard; Active Sulphur; Chlorine (H, M) Lard; Active Sulphur (H) Lard; Inactive Sulphur (H) Soluble Oil and Water
3	Tapping and Threading (*Plain*)	HS HS	Lard; Active Sulphur (H, M, L) Lard; Inactive Sulphur (M)	HS HS	Lard; Active Sulphur; Chlorine (H, M) Lard; Active Sulphur (H, M)
4	Gear Cutting, Gear Shaving and Reaming (*Plain*)	HS HS CC	Lard; Active Sulphur (H, M, L) Lard; Inactive Sulphur Lard; Inactive Sulphur (M)	HS HS CC	Lard; Active Sulphur; Chlorine (H, M) Lard; Active Sulphur (M, L) Lard; Inactive Sulphur (H)
5	Drilling (Deep), Gun Drilling	HS HS HS CC	Lard; Active Sulphur (M, L) Lard; Inactive Sulphur (M) Soluble Oil and Water Soluble Oil and Water	HS HS CC CC	Lard; Active Sulphur; Chlorine (H, M) Lard; Active Sulphur (H, M, L) Lard; Inactive Sulphur (H) Soluble Oil and Water
6 7	Milling and Boring, Multiple Spindle Automatic Screw Machines and Turret Lathes: Drilling, Forming, Turning Reaming, Cutting Off, Tapping and Threading	HS HS CA CC	Lard; Inactive Sulphur (H, M, L) Soluble Oil and Water Soluble Oil and Water Soluble Oil and Water	HS HS CA CC CC	Lard; Active Sulphur (L) Lard; Inactive Sulphur (M) Lard; Inactive Sulphur (L) Lard; Inactive Sulphur (L) Soluble Oil and Water
8 9	High Speed, Light Feed Automatic Screw Machines: Drilling, Forming, Tapping, Threading, Turning, Reaming, Box Milling and Cutting Off, Drilling, Planing, Shaping and Turning	HS CA CC	Lard; Inactive Sulphur (M, L) Soluble Oil and Water Soluble Oil and Water	HS HS HS CA CA CC	Lard; Active Sulphur (L) Lard; Inactive Sulphur (M) Soluble Oil and Water Lard; Inactive Sulphur (L) Soluble Oil and Water Soluble Oil and Water
10	Sawing		Soluble Oil and Water Lard; Inactive Sulphur (L)	— —	Lard; Inactive Sulphur (L) Soluble Oil and Water
10	Grinding		Soluble Oil and Water	—	Soluble Oil and Water
10	Thread Grinding, Etc.		Lard; Active Sulphur and Chlorine with Light Mineral	—	Lard; Active Sulphur and Chlorine with Light Mineral

FOR OTHER EASIER CUTTING METALS

MAGNESIUM ALLOYS

(1-10)	HS	Light Mineral Oil
	CC	Light Mineral Oil

ALUMINUM

(1-10)	HS	Concentrate and Kerosine
(6-10)	HS	Soluble Oil, Water and Kerosine
(6-10)	CC	Soluble Oil and Water

BRASS AND BEARING BRONZE

(1-10)	HS	Lard and Mineral (H, M, L)
(6-10)	CC	Dry

ZINC

(1-10)	HS	Soluble Oil and Water
(6-10)	CC	Soluble Oil and Water

Numbers in Parentheses refer to Order of Severity

FOR OTHER HARDER CUTTING METALS

COPPER AND GUN METAL

(1-10)	HS	Lard and Mineral (H, M, L)
(6-10)	HS	Soluble Oil and Water
(1-10)	CC	Soluble Oil and Water

EVERDUR (Silicon Bronze)

(1- 5)	HS	Lard and Mineral (H, M, L)
(6-10)	HS	Soluble Oil and Water
(1-10)	CC	Soluble Oil and Water

MANGANESE BRONZE

(1 -5)	HS	Lard and Mineral (H)
(6-10)	HS	Lard and Mineral (H, M, L)
(1-10)	CC	Soluble Oil and Water

NICKEL, MONEL METAL AND INCONEL

(1-10)	HS	Lard; Active Sulphur (L)
(1-10)	CC	Soluble Oil and Water

TOOL MATERIAL
HS—High Speed Steel
CA—Cobalt Alloys (Stellite)
CC—Cemented Carbide

STRENGTH OF COMPOUNDING
(H)—High
(M)—Medium
(L)—Low

SINCLAIR REFINING COMPANY

By Byron M. Hoover

Estimating Tool Costs for Mass Production

In modern industry, science has superseded the "shrewd guess" in the pre-determination of tool costs.

THERE are various approaches to cost estimating of tools since, to a considerable extent, method of estimating will depend on the experience of the estimator. Hence, it is rather improbable that any two estimators would attack the problem from exactly the same angle.

An experienced estimator, for example, or a veteran tool engineer or tool room superintendent, thoroughly familiar with tools, machines and methods, can often as not make a shrewd and, usually, a surprisingly accurate estimate from a more or less casual study of a parts print or assembly. Not only that, they can closely approximate the rate of production possible with the tools or, the desired production stated, suggest the tools to attain it.

However, there is the old saying that familiarity breeds contempt, and while men so experienced may guess right in the majority of cases, one wrong guess may so put a job in the red that a score of reasonably accurately surmises may be entirely cancelled out. And that is not considered good business.

Byron M. Hoover **has been previously introduced to our readers, as in the *Symposium on Plastics* in the July TOOL ENGINEER. To that, it may be added that, for a number of years, he has been in charge of cost estimating at the Midland Steel Products Co., Detroit plant.**

There is the further consideration that, due to the drain on industrial manpower because of induction into the armed forces, there is a considerable gap—say about four years—in what may be termed the normal bridge between experienced shopmen and younger journeymen and apprentices. And many capable estimators have been drawn from the shops—in fact, both practical and technical training is highly desirable in cost estimating.

What holds true for the practical fields also holds for the technical. College men have been diverted into the Service instead of into industry, and while this diversion has been necessary, because of the emergency, the net result is an "aching void" as far as engineering replacements are concerned. As a consequence, we have neither practical nor technical reserves, with the result that a greater burden is imposed on the minority left to carry the load.

At first thought, the foregoing may seem to be a digression from the subject. However, it has a definite bearing on cost estimating in that we must establish, if not exactly new and novel, at least different approaches to old problems. There being a deficit of experience, we must supersede this with science.

It should be borne in mind that, in mass manufacture, profits are closely figured. Contrary to what seems to be a widespread misconception, the profit over cost on manufactured products is very small—so slight that, in many instances, one per cent over or under may mean the difference between profit and loss.

This article is in direct response to numerous requests for information on estimating tool and die costs, and is written by an authority who has devoted many years to the subject. In addition to a general resumé of the elements involved, the author discusses several comparatively simple jobs as examples for study.

The article is intended for students or beginners rather than for experienced estimators, hence, both parts and tool drawings are reduced to their simplest terms and shown without dimensions. However, the reader can determine approximate proportions from comparison of the parts which—in one case at least—are prominently delineated, and the tools.

Ed.

That, of course, does not mean that a business can be successfully maintained on so slight a margin, but that accumulation from repeated turnovers result in reasonable annual profits. Inversely, accumulation of even minor losses may result in a disastrous deficit. All this considered, it will be readily seen that accurate cost estimating is an integral and vital part of modern industry. Therefore, guesswork must be replaced with exactness.

As previously stated, there are various approaches to cost estimating although, in the final analysis, they all boil down to two elements—time and material. In turn, both are reduced to dollars and cents, and the total pro-rated over the job with a further provision for maintenance and replacements.

The first step, in cost estimating, is to thoroughly study the job and to determine its most economical processing. From that, one will arrive at the number of operations required, and their sequence. This, in turn, will determine the number of tools required for each operation, and the machines to be used—that is, within reasonable or arbitrary limits as the case may be.

Machines Used Determine Tools

This preliminary survey need not necessarily be the duty of the estimator, although it often is. In many plants, the preliminary survey is made by process engineers, or by one or several production executives, who then determine its processing and suggest the tools to be used. This information is then passed on to the estimator, who breaks it all down into costs.

In the matter of machines, stampings (as an example) may be made in any one of several similar presses, or, depending on quantity or peculiar conditions, may be confined to one particular press or make of press. For instance, it would make a considerable difference, in the type of dies and the incidental cost, whether the job is to be run in a single stroke press, as a Toledo, or continuously as in a Henry & Wright.

The same would hold true for milling machines, engine or turret lathes, drill presses, grinders, gear cutters and so on. Once the machines are agreed upon, one proceeds to line up the various tools—dies, fixtures, cutting tools, gages

and other necessary equipment. Largely, the type of machine used will determine the design of tools and their cost.

Now, taking up a simple proposition, we propose to "estimate" the tools for an assembly involving two simple brackets to be riveted together as a final operation. See Fig. 1. The one part is an angle stamping of mild steel, requiring blanking, piercing and bending; the other, a Zee shaped malleable casting, is to be disc ground on one face, milled on the other, and drilled.

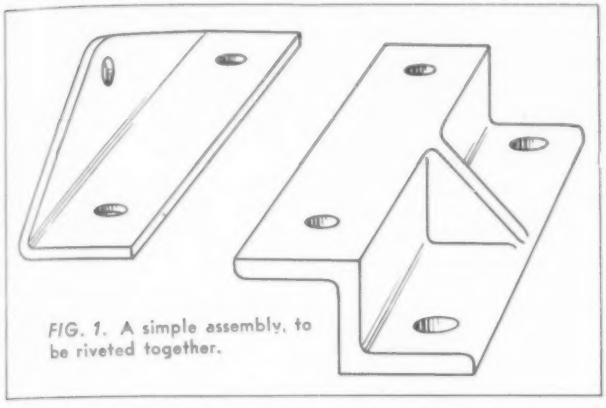


FIG. 1. A simple assembly, to be riveted together.

We will now estimate tool costs. For the two first operations on the steel angle, we will use standard die sets, as the Danly 0610-FEI. For the 1st operation, we will require a blanking die and punch, and for the second, a die and punch holder, to be respectively bored for button die inserts and standard replaceable punches. Here, both punch and die holder can be of mild steel since both merely act as holders or retainers for the inserts.

For the 3rd operation—banding—a very simple Vee die and punch will suffice. And here, too, mild steel, carburized and hardened, will serve the purpose, although alloy or tool steel may be specified. In either event, the units would be pack hardened or hardened, as the grade of steel may warrant. We then set up our cost estimate as follows:

Op. 1. Blank	
Danly 0610-FEI Die Set*	$ 36.00
Labor, 18 hrs. @ $1.25 per hr.	22.50
Burden, 100%	22.50
Tool Steel, 16 lbs. @ .35	5.60
Screws, dowels, etc.	1.60
Engineering and design, 8 hrs. at 2.00	16.00
	$104.20
Op. 2. Pierce	
Danly 0610-FEI Die*	36.00
Labor, 26 hrs. @ 1.25 per hr.	32.50
Burden, 100%	32.50
Boiler Plate, 30 lbs. at .10	3.00
4 std. 21/64" round punch & die sets @ 1.44 ea.	5.76
Screws, dowels, etc.	1.10
Engineering and design, 6 hrs. @ 2.00	12.00
	$122.86
Op. 3. Form	
Labor, 16 hrs. @ $1.25 per hr.	20.00
Burden, 100%	20.00
Boiler plate, 40 lbs. @ .10	4.00
Machine steel, 36 lbs. @ .08	2.88
Screws, dowels, etc.	1.80
Engineering and design, 7 hrs. @ 2.00	14.00
	$ 62.68
Total for 3 dies	$289.74

* Salvable for future use.

With regard to the casting, we have three operations as previously stated: (1) Disc grind one face (no special tools)*; (2) Mill one face and (3) drill four 21/64" holes. For operation 2, a milling vise with special jaws would suffice, and for operation 3 we would use a pump jig, as a Swartz, Woodworth or comparable. With the latter, we would require a locator and standard replaceable drill bushings, with liners.

For the final operation—riveting—we would require a hydraulic riveting unit, as a Hannifin. This would include a 17½ ton pump unit (or generator), a 12½ ton work cylinder, and a C-frame riveter yoke, with dies for round head rivets. We then estimate as follows:

Op. 1. Disc grind. No tools required.	
Op. 2. Mill. Use stock milling vise with special jaws.	
Labor, 8 hrs. at 1.25 per hr.	$ 10.00
Burden, 100%	10.00
Tool Steel, 8 lbs. at .30	2.40
Engineering and design, 4 hrs. @ $2.00 per hr.	8.00
	$ 30.40
Op. 3. Drill 4 holes.	
Commercial Pump Jig*	43.50
Labor, 18 hrs. @ 1.25 per hr.	22.50
Burden, 100%	22.50
Tool Steel, 8 lbs. @ .28	2.24
Machine steel, 12 lbs. @ .08	.96
4 std. drill bushings @ $1.55	6.20
4 std. liners @ $1.15	4.60
Miscl. screws, dowels, etc.	1.80
Engineering and design, 12 hrs. @ $2.00	24.00
	$128.30

* Salvable for future use.

Op. 3. Assemble.	
Use Hannifin Hydraulic Riveter.	
3 sets. 5/"16 Round Head dies at $5.00 (2 sets for spares)	15.00
Total for job	$463.44

We have, however, salvable items which, when the job is completed, may be used on future jobs. These are the Danly die sets and the pump jig, totaling $115.50. If these items are deducted, the total tool cost is only $374.94. As for the Hannifin Riveter, this has been considered as part of the plant equipment—i.e., as capital investment, but, it is entirely possible that this may be included in the over-all cost, when we would add:

1 Hannifin Hydraulic 17½ ton Riveter Pump Unit	$560.00
1 Hannifin Hydraulic 12½ ton cylinder	125.00
1 Hannifin C-frame Riveter Yoke	185.00
	$870.00

If, then, we considered none of the items salvable, but included all in the total tool cost, we would have a sum total of $1,333.44.

It might be of interest, here, to show what the unit costs for the assemblies would be, using each of the three sets of figures—i.e., the first item of $463.44, for tools complete without salvage consideration; the second item of $347.94, and the third of $1,333.44. If we consider 5000 assemblies in the job, these would be pro-rated as follows:

Item 1. 5000: 463.44 = .09268 = .093
Item 2. 5000: 347.94 = .06958 = .07
Item 3. 5000: 1333.44 = .2666 = .27

From these comparisons, it will be seen that the riveter equipment could be amortized in a run of 15000 assemblies, using round figures. That is, 15000 assemblies at 9c each would be absorbed in $1,350.00. Of course, parts production

has not been considered in the above. If the entire job were considered, however, one would assume a unit cost that would hold whether one produced 5000 or 15000. It will also be apparent that the estimate covers actual tool costs only, not a profit. Of this, more later.

We will now estimate another comparatively simple stamping, (Fig. 2), a flange reinforcement such as is used

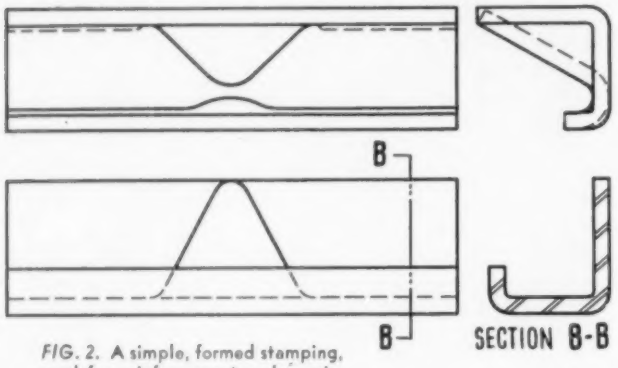


FIG. 2. **A simple, formed stamping, used for reinforcement and requiring comparatively simple dies.**

in the front cross member in automobile frames. The procedure follows; with the dies shown in Figs. 3 and 4, A and B.

Op. 1. Blank. Use Danly Die Set from stock.

Eng'g. and design, 7.25 hrs. @ $2.00	$ 14.50
Layout (of blank)—4.75 hrs. @ $1.50	7.13
Labor, 60 hrs. @ $1.50	90.00
Tryout, 2 hrs. @ $1.50	3.00
Burden, 110%	102.30
Tool steel, 26.5 lbs. @ .37	9.81
Boiler plate, 18 lbs. @ .07	1.26
Screws, dowels and miscl.	1.60
	$229.60

Op. 2. Form. Use Danly Die Set from stock.

Eng'g. and design, 24.5 hrs. @ $2.00	49.00
Labor, 139 hrs. @ $1.50	208.50
Tryout, 13.5 hrs. @ $1.50	20.25
Burden, 110%	251.63
Tool Steel, 47 lbs. @ .37	17.39
Boiler plate, 60 lbs. @ .07	4.20
Screws, dowels and miscl.	2.30
	$553.27

Total for both dies $782.87

The reader will have noticed, by now, a slight variation, rather than any marked discrepancy, in hourly rates and in material prices, as compared to the previous estimate. There is also a difference in burden, the above being set at 110%, the preceding at an even 100%. It happens, however that the figures were taken from two different plants and that the estimates were by two different men. Despite this, there is a close similarity in procedure.

We will now estimate tool costs for a spring hanger, also used on automobile frames. See Fig. 5. The material is malleable iron, and the following operations are required to machine complete: (1) Gang pierce 4 rivet holes; (2) Drill shackle holes; (3) Mill bolt stop; (4) Ream shackle hole and (5) Inspect. Estimates follow in that order.

Op. 1. Gang pierce 4 rivet holes. Use 2-stage die; 2 holes in flange, 2 holes in web. (See Fig 6, A and B).

Eng'g. and design, 11 hrs. @ $2.00	$ 22.00
Labor, 61 hrs. @ $1.50	91.50
Tryout, 1 hr. at $1.50	1.50
Burden, 110%	102.30
Material—as tool and mild steel, misc.	31.40
	$248.70

We will now break tool fabrication into elements, as:

Burning (to shape)	1 hrs.
Milling	3 hrs.
Shaping	4 hrs.
Turning	4.5 hrs.
Boring	6 hrs.
Hardening	1 hrs.
Grinding	7 hrs.
Assembly & Miscl. fitting	34.5 hrs.
Total	61 hrs.

Op. 2. Drill shackle bolt holes in line. (See Fig. 6)

Engineering and design, 9 hrs. @ $2.00	$ 18.00
Labor, 38 hrs. @ $1.50	57.00
Tryout, 1 hr. @ $1.50	1.50
Burden, 110%	64.35
Miscl. material, bushings, etc.	33.15
One air cylinder, 2" dia. x 3" stroke	27.00
Total	$201.00

Again breaking down into elements, we have:

Burning	1.5 hrs.
Shaping	3.5 hrs.
Milling	2 hrs.
Boring	1.5 hrs.
Hardening	1 hrs.
Grinding	1.5 hrs.
Assembly	27 hrs.
Total	38 hrs.

FIG. 3. **Blanking die.**

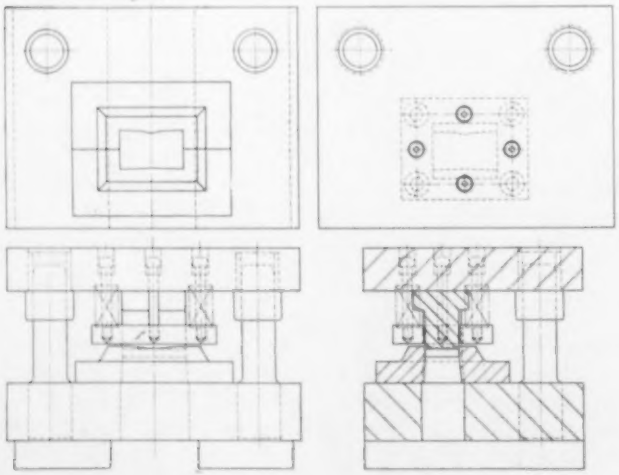
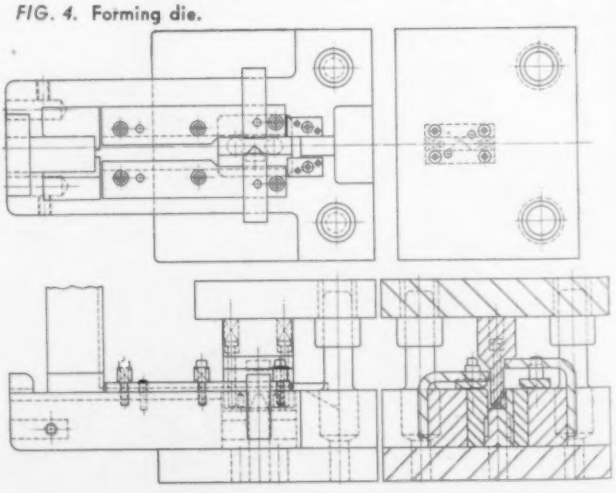


FIG. 4. **Forming die.**



Op. 3. Mill bolt stop. Milling fixture. (See Fig. 8)

Engineering and design, 6 hrs. @ $2.00	12.00
Labor, 15 hrs. @ $1.50	22.50
Burden, 110%	24.75
Material	6.93
Total	$ 66.18

Op. 4. Ream bolt holes. Free, in drill press, no fixtures required.

Op. 5. Inspect. Purchased gages and visual.

Total tool cost as made in plant tool room $515.88

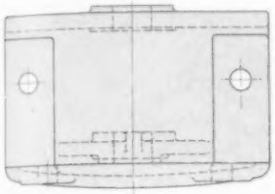
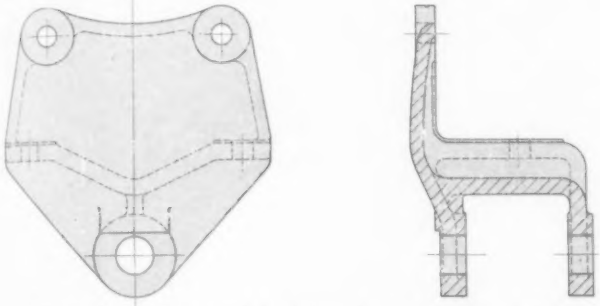


FIG. 5. Malleable iron spring hanger, used on automobile frames.

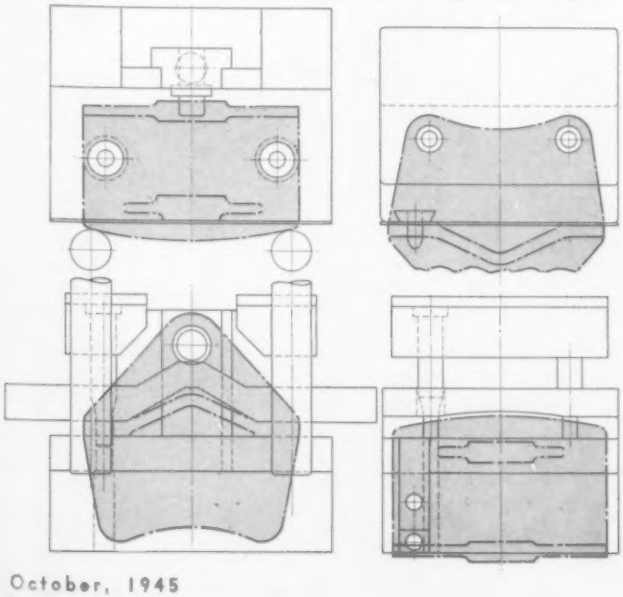


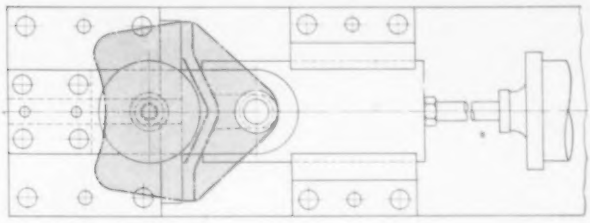
It may be well to explain, here, that no attempt has been made toward super-accuracy in the above estimates. They are purely illustrative and cover essentials. For example, burden—or overhead—will vary from plant to plant, and the estimator will have to use local figures. While labor costs may not vary to any great extent in any one locality, there may be considerable variations between different sections of the country. Again, local conditions will govern.

It will help, immensely, if an estimator has a tangible knowledge of tool room procedures and practices. For example, stock may be cut off in hack saw machines or, if intricate shapes are involved, it may be sawed out (hot sawed if hard) or burned to shape with a torch. Then, when it comes to machining, so much is shaping or milling, so much jig boring, so much grinding and lapping, so much assembly and fitting, and so much is try-out. All these things, including layout, must be considered in the estimate.

FIG. 6A *FIG. 6B*

Progressive dies used to pierce rivet holes in casting shown in Fig. 5.





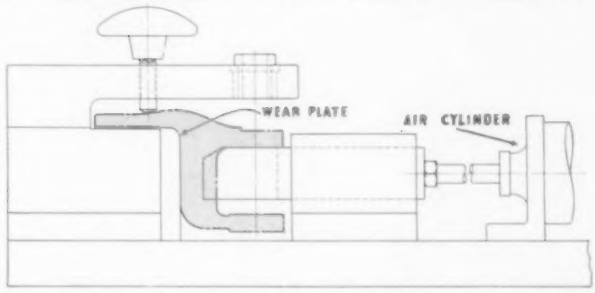


FIG. 7. Drill jig for drilling the bolt hole in part shown in Fig. 5.

All accessories as screws, dowel pins, hand knobs, die springs and so on must also be included in the tool costs, as should hardening and heat treating and, naturally, engineering and design. One should also allow reasonable time for set-up and, where a job is involved, for experimental work. One should also ascertain if the tool can be made in the plant tool room or if it must be contracted out. In the latter case, a rough estimate should be set up, for control, although one would establish cost according to the figures of the low bidder.

On the whole, however, one can establish labor costs by keeping a record over a period of time, until the various operations entailed in tool manufacture become almost second nature. For example, jig boring may be established at so much per hole, and other machining operations likewise recorded. It would be a mistake, however, to figure tool room costs on the same basis as production.

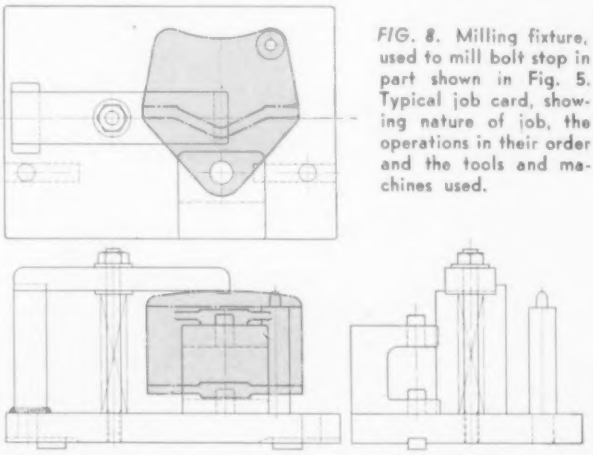


FIG. 8. Milling fixture, used to mill bolt stop in part shown in Fig. 5. Typical job card, showing nature of job, the operations in their order and the tools and machines used.

In production estimating, one might estimate milling time at 4 inches per minute (using round figures) but, we would hardly set such arbitrary rates in cases where steel may vary from mild to tough alloys, and where precision layout is a prime consideration as compared to machining in fixtures. However, the time to mill two similar castings, or to set up and bore in-line holes in two comparable fixtures, should not vary overly. It can all be reduced to a science, and in many cases may have to be so reduced. Nevertheless, experience is a big help.

Tool costs may run from a few dollars, for comparatively simple, short run jobs, to many thousands where the job is equally simple but where large quantity warrants the most economical techniques of manufacture. In the case of complicated assemblies, costs may run from $25,000, as a comparatively minor consideration, to several hundred thousand dollars. In a considerable number of cases the saving of a fraction of a cent, in the manufacture of a part, or of a few cents at the most on mass produced assemblies, may easily warrant the outlay of $25,000.

As an example, take a production of 2000 assemblies per 8 hour day. If the cost should be $1.00 per assembly (again using round figures) and the job runs a year, the total for the year would be $520,000, figured on a 5 day week. If a method were evolved whereby a saving of 5c per assembly could be effected, this would imply a saving of $26,000 per year. If the job runs one shift per diem, the manufacturer would be justified in spending up to at least 75 per cent of this amount for improved tools. And, should the job require two shifts per diem, he would be justified in spending the entire $26,000—perhaps more. In either event, he would be assured of a reasonable return on investment.

These savings, however, cannot be merely guessed at, but must be carefully pre-estimated, with all contingencies taken into consideration. For instance, an impending change in wage rates would be a factor, as would changes in plant layout and disposal of existing equipment. Inversely, salvage is also a consideration, as when commercial units, motors, air or hydraulic cylinders, etc., etc.,—may be diverted to other uses.

All that, however is "big stuff" that as a rule, involves major engineering and plant layouts, with the varying components separately itemized and estimated and to be finally compiled into a sum total which, in turn, may be allocated to plant or capital investment. When costs run to such proportions, however, one just doesn't make mistakes.

Keyway and Grooving Machine for Babbit Linings

The machine described and illustrated here is a product of the Apprentice Division of the Lynn River Works, General Electric Company, West Lynn, Mass., and typifies the constructive apprentice training in force at the G.E. plants.

Ed.

IN ORDER to supply babbit linings fast enough to meet a stepped-up production schedule, the Apprentice Division at General Electric's River Works designed and developed a machine to facilitate milling of oil grooves and keyways in these linings. This machine, which is shown in Fig. 1, has not only reduced milling time of the operation 65 per cent, but has also minimized spoilage to a negligible amount.

The machine consists of a base on which is mounted an internal grinder head with a special spindle carrying the end mill and a Carboloy fly cutter. The cutter is powered by a fractional-hp motor which furnishes a spindle speed of 4500 rpm. There are three separate levers. One actuates the work slide horizontally, another vertically, while the third moves the spindle-head slide from front to rear position. Safety stops on these levers prevent them from operating when the work is in the wrong position.

The babbit lining is fastened to the work holder by means of a tapered drift. The drift fits against ends of the oil pocket of the lining, thus automatically aligning the work. The work holder is attached to the ram of the work slide by screws inserted in slots in the holder, thereby permitting easy alignment and adaptation of different holders for various types of babbit linings. Keyed to a ram is an eight-tooth ratchet wheel. As the work slide approaches the extreme left-hand position, a ratchet finger engages the tooth; continuation of this motion indexes the work ⅛ of a turn. When the work slide lever is moved to the left, the work is positioned under the cutter and one oil groove is milled. Upon reaching the stop at the end of the stroke, the work is automatically indexed, and the next groove is cut on the return stroke.

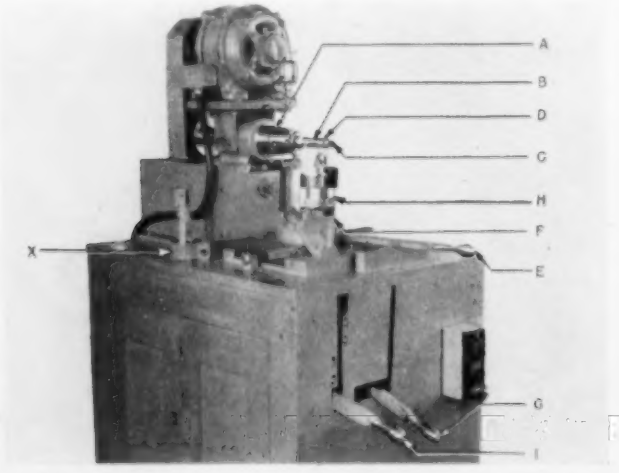


FIG. 1. Special machine (without cutter guard) for milling oil grooves and keyways in babbit linings. *A*—internal grinder head, *B*—special spindle, *C*—end mill, *D*—Carboloy fly cutter, *E*—lever, *F*—work slide, *G*—vertical operating lever, *H*—work support, *I*—front-to-rear operating lever. *X*—cutter with guard removed.

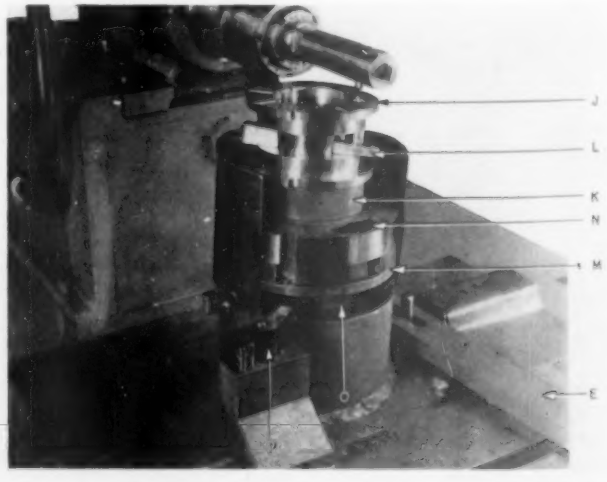


FIG. 2. Close-up of work slide and spindle in position for cutting oil groove in babbit lining, *J*—lining, *K*—work holder, *L*—tapered drift, *M*—ram, *N*—screws, *O*—eight-tooth ratchet wheel, *P*—ratchet finger, *E*—handle lever.

The ratchet wheel has eight sockets into which round-headed pins fit after indexing. The pins are held in the sockets by coil springs, and during the indexing they are forced down into slots in the bed. The slots are only of sufficient length to accommodate the pins during indexing. If the work should fail to index properly, the pins, still displaced, would come in contact with the end of the slot, thus preventing the slide from moving under the cutter. By placing the screw in any desired socket, the cutting operation of the corresponding groove is eliminated. The lining has seven oil grooves spaced on the basis of eight divisions; a screw being placed in one socket to eliminate one groove.

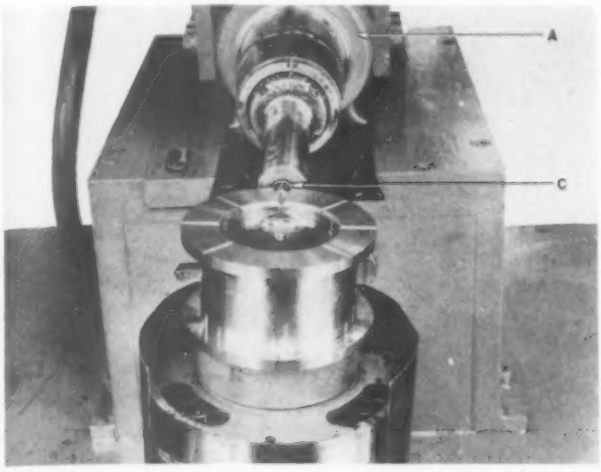


FIG. 3. Close-up of workholder and spindle in position for cutting keyway in babbit lining. *A*—cutter head, *C*—end mill.

The work support is tilted at an angle so that the grooves are cut deeper toward the center of the lining.

For cutting the keyway, the work slide is pushed back to its extreme right-hand position against an adjustable stop. This brings the work to a position where the centerline of the lining passes through the centerline of the end mill. A lever pushes the cutter head to its furthermost position from the work. The location of the cutter head, when in either cutting position, is controlled by one of two adjustable stops which strike against a cam on the bottom of the cutter head and force it up against the ways, thereby preventing vibration. A lever, which actuates the ram and work holder up past the cutter, moves vertically with the work slide and in a slot in the apron. This slot is so shaped that the lever can be operated only when the work slide is in the proper position for cutting the keyway.

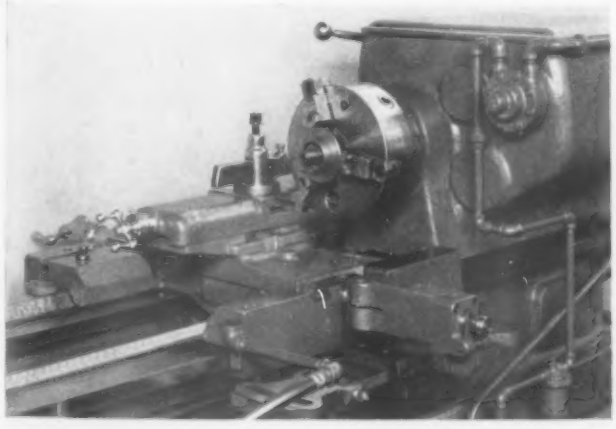
FIG. 4. Finished babbit bearing lining showing oil grooves and keyway produced with special machine.

Intricate Threading On Stock Lathe

As an example of Yankee ingenuity, the job shown in the photograph consisted of a coarse lead stem, with the thread running back under a protecting shell and ending at the same point, with no relief for tool clearance. To aggravate the problem, the threads were required to be cut at production speeds. Not easy!

All things considered, a method of withdrawing the threading tool at the same point had to be developed. This, naturally, also entailed resetting the tool for each new cut, and at safe increments of feed. The problem was solved by an arrangement which withdraws the tool at the desired point by means of the reversing mechanism resetting the tool to the correct cutting depth.

The mechanism, which is practically automatic in operation, was developed by the *Springfield Machine Tool Company*, of Springfield, Ohio, for use on a stock Springfield Geared Head Lathe.



Case Hardened Grinding Wheels

AMONG RECENT developments in the grinding field, a new method of "case hardening" grinding wheels is said to impart a surface hardness comparing favorably with that of a diamond wheel. The process, which is a development of the Connecticut Research Foundation, is controlled by the Bridgeport Safety Emery Wheel Co., Inc., of Bridgeport, Conn., and is offered by that company under the trade name *BuXite*.

As applied, the BuXite process coats the surface grains of a grinding wheel and, under the heat and pressure of grinding, the coating imparts a surface layer or "case" of extreme hardness. As a result, it is claimed that sintered carbide tools, and similar hard alloys and metals, may now be reduced at a rate previously considered impossible with standard grinding wheels.

Exhaustive tests have shown that a processed wheel cuts cleanly and with an easy cutting quality that tends to relieve pressure on the grain. This allows the wheel to cut longer before wearing down or breaking out-of-bond, thereby greatly extending its life as compared to unprocessed wheels. Furthermore, wheels so processed are said to permit grinding both shanks and tips of carbide-tipped tools without loading. This would permit this previously difficult and expensive grinding to be done by average workmen under ordinary shop conditions and, to an extent, would obviate the use of dual wheels for carbide grinding. It would also imply equally satisfactory results on non-ferrous metals, in addition to cast iron, tool steel and ferrous alloys.

Of particular interest to industry, in view of the growing practice of thread grinding and, now, the trend toward crusher dressing of grinding wheels, is the claim that BuXite processed wheels show excellent performance on form grinding. The processed wheels are said to cut more easily, with a higher gloss—i.e., quality of surface finish—and less breakdown of contour than with unprocessed wheels.

By J. C. Beattie

Meehanite--an "All-Around" Die Material

An "engineered" metal provides unusually wide application in die manufacture.

METALLURGICAL advancement in the production of cast metals is one of the most active and important parts of current industrial progress. Among metallurgists, engineers, purchasing men, and designers, there is found a great deal of interest in the specific development and improvements in die materials.

Perhaps, among the many achievements in both irons and steels, the discovery and progressive development of Meehanite metal is of particular significance, affecting, as it does, the entire cast metal picture. For with this discovery, it is possible to produce castings with pre-determined, specific, and uniformly dependable properties. This definite and positive control of engineering properties, plus the resultant improvement of qualities, constitutes the real metallurgical achievement of importance to producers and users of metal working dies.

Mr. Beattie **is connected with the Fulton Foundry and Machine Co., Inc., Cleveland, Ohio as Sales and Development Engineer. For the past ten years he has specialized in the application of Meehanite for the manufacture of dies used in the stamping industry and in its application to precision tool room accessories.**

Meehanite is manufactured to rigid specifications, under the following general classifications.

1. General Engineering Castings (tensile strengths—30,000 to 55,000 p.s.i.)
2. Wear Resisting Castings (Brinells—240 to 550)
3. Heat Resisting Castings (non-scaling and non-growing up to 1600 degs. F.)
4. Corrosion Resisting Castings (according to requirements).

The various Meehanites provide a well-rounded group of materials whose general adaptability and mechanical properties make them the answer to numerous engineering and design problems. Perhaps the chief advantage Meehanite Metals offer industry is the consistent uniformity of metal structure throughout variations of casting section. This uniformity insures dependability and freedom from structural failures.

To understand the difference between Meehanite, ordinary cast iron and cast steel, it is necessary to examine some factors which influence the mechanical and physical properties of these materials.

The composition and structure of ordinary cast iron is, more or less, indeterminate and for this reason it is no longer suitable for the high standards set in modern engineering practice. During solidification in the mold, cast iron becomes a mechanical mixture of graphite in a base matrix consisting of a number of constituents. This is shown in Figure 1. The flakes of graphite appear as black streaks. They are in reality thin saucers which occur in all planes and intersect one with another to form continuously interlocking graphite structures through which fluids can seep even at normal low pressures. The flakes lie at all angles and in all directions, the thickness of the streaks in the photomicrograph indicating the angles at which the section intersects the flakes. In the softer grades of gray cast iron, the graphite occupies from 10 to 13% of the volume of the casting.

Figure 1 depicts an attempt to show in three dimensions the distribution of graphite in ordinary cast iron. From this may be judged the effect of the continuous interlocking form of the graphite structure upon the mechanical properties and solidity.

A standard steel casting has a somewhat similar base matrix structure to ordinary cast iron, except there is not free graphite present. In other words, one would expect ordinary cast iron and a steel casting to behave similarly with the exception of the presence and effects of the 10% or more volume of graphite flakes.

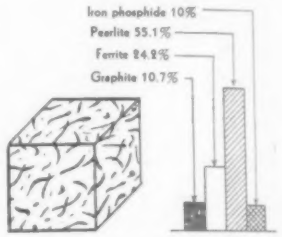


FIG. 1

In Meehanite the quantity and form of the graphite are under control. Of two types of Meehanite—GC and GM—the actual volume of graphite is 8.3% and 6.7% respectively, and is deposited in the form of small uniform flakes so that the whole mass retains a high degree of solidity and homogeneity.

In Type GC Meehanite, there are fewer graphite flakes flakes than in ordinary cast iron, and these assume a form that is less weakening to the strong and tough pearlite matrix; hence, this material combines good strength properties with improved solidity but retains free machining characteristics.

In the case of Type GM Meehanite, the graphite flakes do not interlock; therefore, they do not destroy the physical properties of the base matrix but preserve the high qualities of carbon tool steel in combination with an improved rigidity and co-efficient of friction value.

Figure 2 depicts a block of Meehanite Type GA, in three dimensions. A comparison of this with that of ordinary gray cast iron (Figure 1) shows how the Meehanite Process improves enormously the quality of castings, avoiding both seepage channels and planes of cleavage.

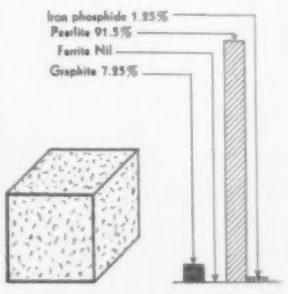


FIG. 2

Another outstanding factor offered by Meehanite castings is the fact that they may be fully hardened by oil quenching or flame-hardened on the surface to achieve even greater hardness and wear resistance.

Tensile strengths above 75,000 and Brinell hardness up to 500 may be achieved by oil quenching while flame hardened surface will approach 600 Brinell to a depth of from ⅛" to

3/16". While fully hardened tool steel may achieve a hardness of 650 Brinell, the base matrix of the hardened Meehanite Casting is just as hard. The lower mass hardness is due to the presence of minute flakes of graphite which permit a deeper penetration of the Brinell ball and thus show a lower hardness number.

With this background of engineering properties it may be easily understood why Meehanite Castings cover such a wide field in the stamping industry.

Properly used, Meehanite has scarcely an equal as a die material and is not only to be considered for temporary dies, but as a replacement material for costly tool steels with capabilities of some work which cannot even be performed with many steels.

DIE MATERIAL INDEX	QUENCHING TEMP °F	QUENCHING MEDIUM	TEMPERING TEMP °F	OTHER TREATMENT *	HARDNESS ROCK "C"	TOTAL NO. OF STROKES DRY	TOTAL NO. OF STROKES LUBRICATED WITH SOAPY WATER	TOTAL NO. OF STROKES LUBRICATED WITH DRAWING COMPOUND
X	1850	AIR	300		61	2	4816	420
X1	"	"	980	CN	62	33	1372	416
X2	"	"	"	AN	62	9	545	66
X3	"	"	300		61	2	436	2337
X4	"	"	980	CN	59	8	3590	510
X5	"	"	"	AN	59	3	1211	510
X6	"	"	300		63	6	1234	66
X7	"	"	1000	CN	60	42	2067	6446
X8	"	"	350		61	2	508	6425
X9	"	"	950	CN	58	9	3742	8557
X10	1740	OIL	300		62	7	5218	7156
XX	"	"	950	CN	57	3	3439	8354
XX1	2200	"	1025		63	2	8	40
XX2	"	"	"	CN	63	2	120	197
XX3	1800	AIR	300		64	25	19	10663
XX4	"	"	950	CN	59	5	998	11118
27	1775	"	300		63	2	445	211
28	"	"	950	CN	58	2	519	427
29	"	"	300		63	3	101	1889
30	"	"	950	CN	59	2	75	1559
31	1800	"	300		63	7	593	4868
32	"	"	950	CN	58	4	755	2728
33	1575	"	300		61	4	1283	192
34	"	"	950	CN	48	2	1648	216
35	1550	"	300		62	4	1177	13
36	1440	OIL	"		62	2	5430	114
37	"	"	280	BRINE	63	2	17	4460
41	1600	"	300		50	3	40	3156
42	"	"	1000		36	2	347	3679
43	1450	WATER	300		64	6	825	4708
44	"	"	280		65	3	234	5232
45	"	"	450		61	1	4	109
46	"	"	280		65	8	927	3774
47	1440	"	300		65	2	2608	1586
48	1475	"	300		65	2	22	3731
MEEHANITE A	AS	CAST			17	7	318	7956
MEEHANITE A	1590	OIL	300		45	13	1206	10330
31	1550	WATER	300		66	2	2	4807
32	"	"	"		66	4	2064	5920
33	"	"	280		62	2	219	1975
34	1525	OIL	"		63	6	360	4944
35	1475	WATER	"		64	3	316	308
56	1650	AIR	"		62	3	13	56
57	1625	WATER	"		66	2	1161	7219

TESTS ON DIE MATERIALS FOR GALLING OR "PICKUP"

THE BEST RESULT ON VARIOUS TOOL STEELS

RESULT ON "A" MEEHANITE

* CN - CYANIDE NITRIDE AM - AMMONIA NITRIDE

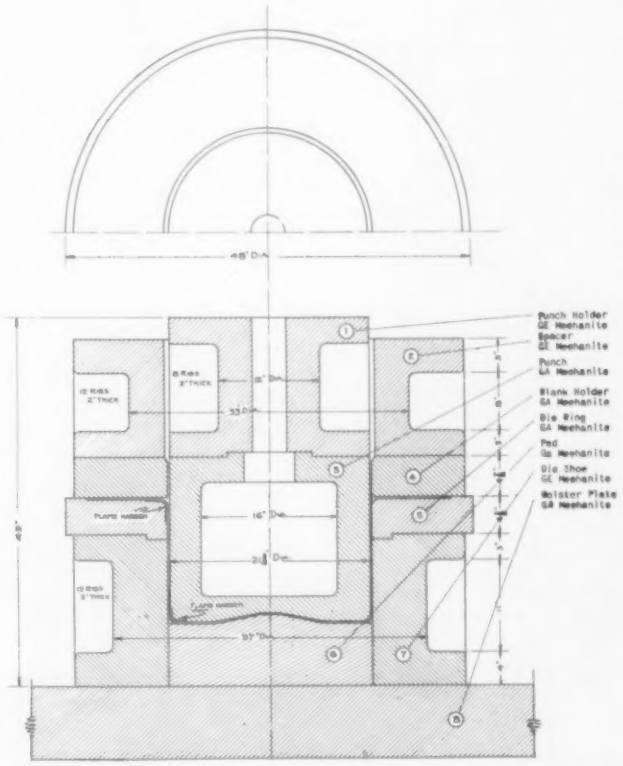
Comparison tests on various materials for galling or "Pick-Up."

Male die as used in manufacture of laminated plastic turret floor for nose gun turret of B-24 Bomber. These dies are chromium plated and pressures run about 250 p.s.i. Photo by courtesy of McDonnell Aircraft Corp., St. Louis, Mo.

Of particular importance are the self-lubricating properties inherent in Meehanite dies because of the finely dispersed free graphite. Further, Meehanite possesses the ability to accentuate the various lubricants which enable such dies to develop quickly a very high polish and smooth wearing surface.

Industrial applications include dies for drawing, forming, draw and pinch trim, embossing, wiring or curling, trimming, blanking, brake bender, preforging for aluminum forgings, spinning forms, press forging, quenching and hot work.

Drawing dies cover a widely varied range of shapes and sizes working in steel, stainless steel, aluminum and other metals ranging from 20 gauge to ½", while in some hot work dies, plates of from 1" to 1½" are drawn in limited quantities. By far the greatest volume of stampings are made from gauges between 14 and 18, and are used for innumerable items, household appliances especially.



Drawing die, for washing machine tub, made entirely of Meehanite castings. Draws tub full length in one operation, with production runs from 25,000 to 750,000 stampings.

Meehanite Die used to stamp Liberty ship ventilator cowls.

In the automotive industry Meehanite dies provide a full year's production run for as high as one-half million pieces or more. Such items as automobile chassis side rails, cross members, engine and radiator mounts, are made in the heavier gauges, while body parts such as doors, window frames, turret tops and gasoline tanks are made from lighter gauges.

Meehanite Has Wide Application

Forming dies are relatively simple, and are not subjected to severe strain. A number of hardened Meehanite dies have been running for several years producing upwards of two million pieces.

In using Meehanite for pinch trimming it is practical to draw and pinch trim cups from light gauges on dies that have been heat treated to maximum hardness.

Embossing dies of Meehanite find wide application in the toy industry and in manufacture of inexpensive table ware. Here Meehanite is successful when the contours need not be held too sharply, and this application extends to items like heat transfer units of stainless steel and many items of food and beverage handling and dispensing equipment.

Dies for large signs in which male and female parts are cast to shape and finished by hand grinding make another interesting application of Meehanite as a die material. One firm made several complete alphabets of large letters on Meehanite dies cast to form. Finished by vitreous enamelling these letters are used for changeable signs of theatres, markets, stores and filling stations.

Curling or wiring dies are used in finishing raw edges on the open ends of shipping containers such as barrels and pails for food, paints, oils and chemicals. Curling dies, properly designed in Meehanite, are nearly permanent.

To some extent the drop forging industry uses trimming dies to remove the flash from forgings. Procedure is to cast the hollow support and top with the forging shape in it in one piece, and after finishing to face the edges with hard facing weld materials like Colmonoy, Stellite, or others.

When blanking is done on hardened Meehanite dies a rough edge is left requiring subsequent finishing. Examples are short run production of odd size barrel or pail tops the edges of which are so formed that the blanked edge is rolled under and entirely concealed from view and touch.

Brake bender dies of Meehanite are efficient for bends of generous or large radii in light gauge sheets, but except in extremely light gauges, bends of 90 degrees with sharp corners must be avoided; generally bending of plates should be avoided as there is seldom room enough for a die having enough body cross section to be sufficiently strong.

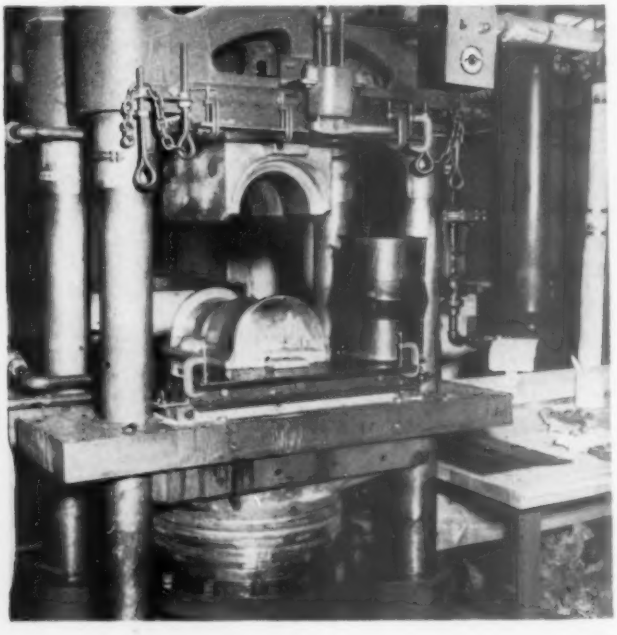
In the production of symmetrical aluminum drop forgings, Meehanite preforging dies have frequently served to eliminate a number of operations and expensive dies. The operation is performed on a hydraulic press, the dies squeezing the billet and distributing the metal into a shape which can be finished in a single drop forging operation.

Die making is an art—not an exact science. Die makers produce good stampings of the same kind on radically different dies. Some have exceptional knowledge and skill, and thus compensate for the use of inexpensive materials, while others are less competent, and even with the most costly materials, design inefficient dies. A poorly designed die simply cannot stand the self-destructive abuse of fast, efficient pro-

Meehanite dies, as cast, for corrugating highway guard rails and for drawing stainless steel automobile headlight shells. Sections vary from 1" to 6" with weights from 50 to 600 lbs.

A typical Meehanite die used in the aircraft industry. These dies show excellent performance in stamping, forming, drawing and pressing operations.

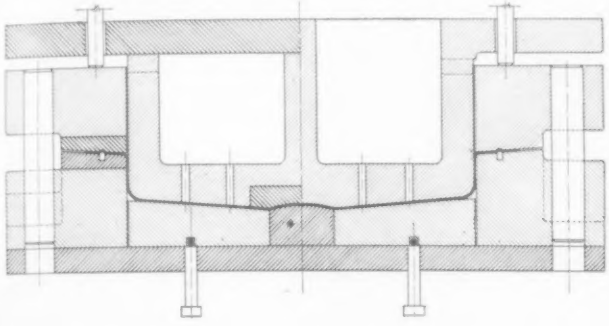
Meehanite die as set up for production of ammunition chute for feeding machine guns on B-24 Bomber.



duction. The stamping industry is localized in a few areas and the accepted methods and materials of die construction will vary from area to area. In some, common cast iron may be the predominating favorite, while in others dies will be made almost exclusively of varying grades of mild or tool steel. The automotive industry, for instance, favors cast iron as a die material for large stampings.

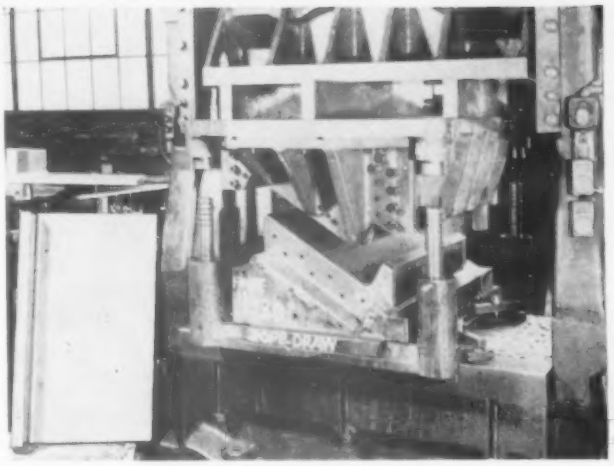
The easy castability of Meehanite also contributes to economics by allowing the manufacture of large, difficult and complicated members with the metal placed exactly where it is most needed to take the load and at the same time reducing machining allowances to a minimum.

A Meehanite forming die that provides long surface life and freedom from galling and scuffing. Piece formed is shown at left. Below, "Bridging the Gap." R.H. section shows typical die assembled from cast iron, boiler plate and tool steel sections. L.H. section shows same die made almost entirely of Meehanite, with working edges flame hardened, thereby eliminating many parts with incidental labor and expense.



It is difficult to build bracing ribs on built-up dies but easy in a casting. For example, it is often possible to replace a number of steel parts with Meehanite Castings and thus save both intermediate machining and metal. When a die must have steel inserts, a good deal of time can be saved by casting recesses for them and leaving tool clearance at the corners with a simple core.

When dies harder than "as cast" are needed, various techniques apply. Small and medium one piece dies may be hardened by a simple quench and draw. Dies on which the



work is not to be too severe may have their term of service trebled by quenching the rough castings and drawing to machinable hardness. Dies 5′ x 10′ weighing 2½ tons have been heat treated by this simple method, so that size is unlikely to impose limitations. Often it is desirable to use a cast iron shoe with hardened Meehanite inserts where adjustment of die size may be needed or machining equipment is inadequate for large heavy parts. Flame hardening offers the greatest economy because the entire die may be completed and tried out and, after all adjustments and reworking are completed to produce a perfect stamping, corners, edges and working faces are flame hardened without hazard of distortion. The die is then ready for long production runs without interruption for regrinding or refitting hardened inserts.

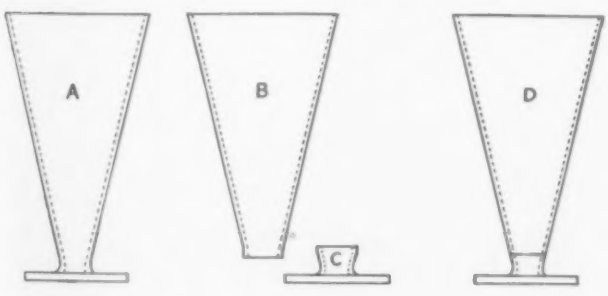
Properly lubricated, the surface of a Meehanite die will cold work to a glass smooth, greasy surface. Any number of compounded lubricants may be used depending on the type of work and metal. However, in cases when subsequent finishing is done by vitreous enamelling, the lubricant must be one that will wash off such as a solution of oil, soap and water.

These factors provide ample evidence that Meehanite has established its position as a die material. Applied intelligently, Meehanite dies will bring very concrete and tangible benefits to the stamping industry.

Swaged Tube Used In Redesign

An example of how redesign, incorporating available shapes and simple techniques, cuts manufacturing costs, is schematically shown in the accompanying diagrams. The part shown at "A" was originally made from a hollow forging, entailing slow and costly machining to reduce the wall thickness to specified dimensions.

To speed production and cut costs, a study was made of the part, and, as a first thought, it was proposed to make



the cone of two stamped sections, to be flash welded together. However, this would have involved serious problems of die construction, both for the stamping operations and the welder. As a better method, it was proposed to flash weld two pieces of the general shapes shown as "B" and "C".

Part "B" was easily made by taper swaging seamless steel tubing of the required wall thickness, to correct diameter and length. The small end was swaged straight, for a distance to compensate for the material lost in flashing and push-up. Part "C" was produced as a stamping, from material similar to that of "B" and of the same wall thickness. This, too, had a straight tubular section, corresponding to the mating diameter of the tube, and also of a length to compensate for flashing and push-up.

The mating ends, being identical in diameter, section and material, presented entirely satisfactory conditions for flash welding, and the assembly ("D") reproduced the shape and dimensions of the original part as shown at "A". Removal of the flash, after welding, was a minor operation compared to the previous machine work necessary on the forging.

THE *Fundamentals* OF TOOL ENGINEERING

The Elements of Gearing

No. 1 of a Series

Broadly defined, gears are wheels with teeth on their periphery. In lay terminology, they are called cog wheels. With two or more gears in a train, one may transmit a constant or intermittent motion, depending on whether the gears so meshed are round, oval or of irregular shape. Meshed with a rack, as in Fig. 1, one may convert rotary into reciprocating motion, or vice versa. In any event, the drive is positive, with absolute recurrence of cycle for each revolution of some one gear in the train. There is no slip, as would occur with belt or friction drive.

Gears may be cast, blanked out in dies, cut or hobbed with rotating cutters, planed or generated. Latterly, they are being shaved, and for extreme accuracy may be ground. While spur, bevel and worm gears are the types most commonly used, each of these is subject to considerable refinement and modification. For example, spur gears may be helical or herringbone, and bevel gears may be spirally cut, for greater quietness and tooth strength. Lately, hypoid gears (spiral bevels in which the drive pinion is below the centerline) have come into use on automobile drives. These types, and others, will be treated later in this series.

First, however, we will discuss tooth forms and the elementary arithmetic of gears. Until quite recently, two tooth forms were used—the cycloidal and the involute. Since, however, the former is but little used now, discussion will be confined entirely to the involute form and its modifications.

While commonly made with 14½° pressure angle, as in the rack, Fig. 1, and also in Fig. 2 (upper and lower left), they are also made with 20° pressure angle, as shown in upper and lower right, Fig. 2. The 14½° pressure angle is used on conventional gears, the 20° on stub tooth gears and on pinions having but few teeth—say from 3 to 8 teeth. The 20° tooth is much the stronger, yet, represents the practical extreme since a greater angle would result in too much side thrust. 14½° and 20° gears will not operate together.

Pitch, of gears, may be designated as circular pitch or as diametral pitch. The first is based on the center to center distance between two teeth on the pitch circle—i.e., that line which would be the line of contact between two plain wheels. Thus, circular pitch would be expressed as ½", 5/8", ¾", 7/8", 1" and so on.

This naturally implies that the pitch circumference would be the exact sum of a given number of teeth and their intervening spaces, or, inversely, that it would be exactly divisible by some certain number of teeth. For instance, a gear with 24 teeth, ½" circular pitch, would have a pitch line circumference of 12", or, 12" : 3.1416 = 3.82"—the diameter of the pitch circle, very nearly. However, circular pitch is not commonly used with small gears or in connection with the finer pitches.

Diametral pitch, which is commonly used, is based on the number of teeth per inch of diameter of the pitch circle. Thus, a 36 tooth gear, 6" diameter, would be 6 pitch. If the gear has 18 teeth, the pitch would be 3; if 72 teeth, it would be 12—i.e., 6" × 12 pitch would be 72 teeth. All this may be calculated with comparatively simple formulas in which the

FIG. 1. Rack meshed with conventional 14½° involute gear. The symbols used in gear calculation are also shown.

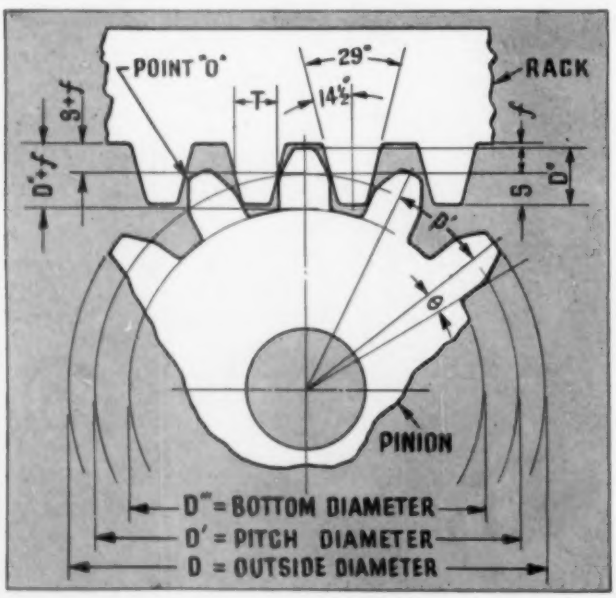
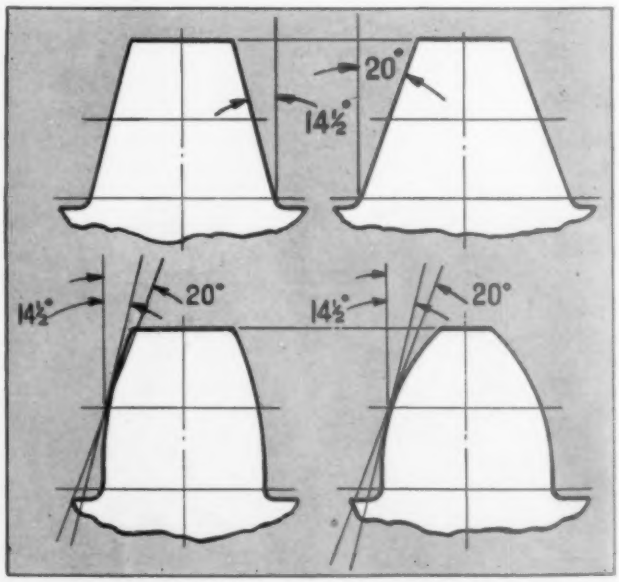


FIG. 2. Left, upper and lower, involute gear tooth with 14½° pressure angle. Right, upper and lower, tooth with 20° pressure angle.



following symbols are used:*

SYMBOLS USED WITH FORMULAS FOR GEAR CALCULATION

P = diametral pitch — i.e., the number of teeth per inch of pitch diameter
N = Number of teeth
D′ = pitch diameter
s = addendum—i.e., the distance from the pitch line to the O.D.
s + f = dedendum—i.e., the distance from the pitch line to the bottom diameter
t = thickness of tooth on pitch line
t″ = chordal thickness of tooth
D″ = working depth of tooth
D″ + f = whole depth of tooth
D = outside diameter
D′′′ = bottom diameter
P′ = circular pitch
H = height of arc
s″ = distance from chord to top of tooth
θ = ¼ the angle subtended by circular pitch
M = module (in millimeters)

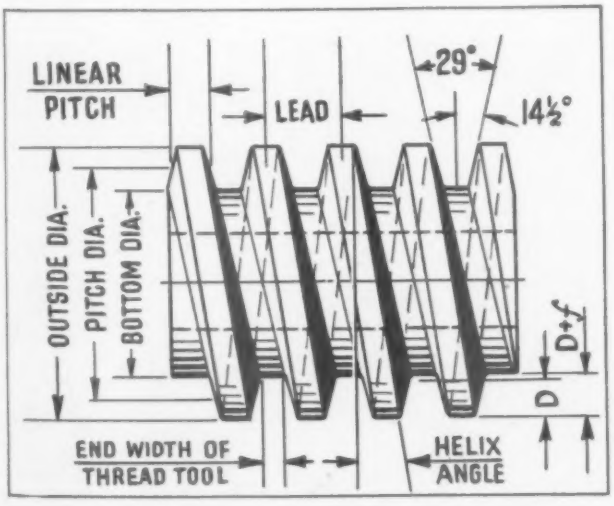
Suppose, now, that we apply the foregoing to a common and entirely practical problem. Choosing a gear, at random, we have the number of teeth, which may be counted, and the O.D., which can be measured. But, we don't know the pitch. Say that we have a gear 8-¼″ O.D. with 64 teeth. We may assume the pitch diameter to be 8″, and the pitch as 8 (8 x 8 = 64) but, as a check, add 2 to the number of teeth, and divide this by the assumed pitch. Therefore, 66 (teeth) : 8 = 8.25″ exactly, thus proving our guess. Incidentally, this establishes the addendum (s) as .125, further proving the gear to be conventional 8 pitch.

It may happen, however, that instead of being 8-¼″ O.D. the gear would be 8.200″, with 64 teeth as before. In this case we would obviously be dealing with a stub tooth gear, in which the pitch would be 8/10. So, by trial—or a shrewd guess—we figure as for an 8 pitch, 64 tooth gear, which gives us 8″ for the pitch diameter. Then, since the addendum (s) of a 10 pitch gear is .100″, our surmise is proven correct by the measured 8.200″ O.D. of the gear.

In this connection, it may be well for readers who intend to follow this series to acquaint themselves with the dimensions of the stub tooth form—or, as it is known, the Fellows Gear Shaper Company's System. Here, the addendum is arbitrarily established as .25 x the circular pitch and the dedendum as .3 x the circular pitch. Tooth thickness (t) is the same as conventional pitch gears.

** The Brown & Sharpe system used here.*

FIG. 3. Plain, single thread worm, showing the various elements of tooth form. Compare with rack in Fig. 1, with which tooth form is identical.



TOOTH DIMENSIONS OF STUB TOOTH GEARS

P	t	s	D″	s + f	f	D″ + f
4/5	.3927	.200	.400	.250	.050	.450
5/7	.3142	.1429	.2858	.1786	.0357	.3214
6/8	.2618	.1250	.250	.1562	.0312	.2812
7/9	.2244	.1111	.2222	.1389	.0278	.250
8/10	.1963	.100	.200	.125	.025	.225
9/11	.1745	.0909	.1818	.1136	.0227	.2045
10/12	.1571	.0833	.1667	.1041	.0208	.1875
12/14	.1309	.0714	.1429	.0893	.0179	.1607

At this point, the reader should reconcile these symbols with those shown in Figs. 1 and 3, as they will be used in all subsequent calculations in this series. In this connection, too, it should be noted that there occurs a certain overlapping of inter-relationship between circular and diametral pitch.

Take the rack and pinion shown in Fig. 1, for example. If the pinion should be 6 diametrical pitch, the rack would, obviously, also be 6 pitch if the two are to operate together. To cut the rack, however, one would have to index in circular pitch—that is, to the center to center distance between teeth or, properly, the center to center distance between the spaces. This would be .5236″ for 6 pitch.

It will also be noted that the worm (Fig. 3) has a straight tooth form similar to the rack, and that linear rather than diametral pitch is used. Outside of that, the tooth form is conventional—i.e., 14½°—with depth of tooth and incidental symbols coinciding with those on the pinion, Fig. 1. However, the nominal circular pitch is designated as lead, which is the center to center distance in one turn of a tooth. This also determines the helix angle, of which more later.

It has been shown, above, that the circular pitch is the center to center distance between two teeth on the pitch circle. Obviously, that does not portend a straight line, nor that the thickness of the tooth on the pitch line and the chordal thickness are the same. Take, for example, the 6 pitch, 36 tooth gear referred to above. 6″ × 3.1416 = 18.8496″ circumference which, divided by 36 = .5236″ which, divided by 2, establishes the tooth thickness, on the pitch line, as .2618″. And this tooth thickness is so established in the handbooks.

To obtain the chordal thickness, however, we would multiply the pitch diameter by one-fourth the angle subtended by the circular pitch, which may be expressed as $t'' = D' \sin \theta$. Since, in this case, there are 36 teeth, the total angle would obviously be 10°, one-fourth of which (θ) would be 2½°. Sin 2½° = .04362 × 6 = .26172″ which is so close to the accepted .2618″ tooth thickness that, to all practical purposes, the difference may be disregarded. Nevertheless, this difference is considered in precision measurement of gear teeth—certainly is a factor in gear calculation.

It will also be noted that there are two terms used for depth of tooth—D″ for working depth of tooth, and D″ + f for the whole depth. The actual working depth is twice the addendum (s × 2 = D″) whereas the whole depth includes a clearance between the O.D. of one gear and the bottom diameter (D′′′) of its mate. This clearance (f) is usually determined as 1/10 of the tooth thickness, or t:10. In the case of the 6 pitch gear previously referred to, this would be .026″ very nearly.

Now, to obtain the O.D. of a gear, we add 2 to the number of teeth and divide by the pitch. Thus, we would add 2 to the 36 tooth gear, giving us 38 which, divided by 6, would give us 6.333″ for the O.D. Then, .333 : 2 would be .1666″ for s or .333″ for the working depth D″. To this, add .026″ and we have .3595″ as the whole depth, or D + f.

Next, in the series, we will discuss the tools used for cutting the involute form.

By Fred M. Burt

The Tooling of Ceramic Products

The Tools, Methods and Materials for Vitrified Pipe Production, with Aspects of Laboratory Research and Control.

The manufacture of sewer crock, with its incidental tooling, may seem rather alien to those of us who move in the metal processing field. And, perhaps, "rough stuff" when compared to the close dimensions prevailing in the metalware industries. Nevertheless, the manufacture of ceramic ware involves mass production on a large scale, and is therefore entirely within the scope of the tool engineer.

Manufacture of ceramic ware entails close control of quality, conservation of material, careful tool and machine design, well considered plant layout, conveyor systems and materials handling, "heat treating" and close inspection—all of the elements of manufacture that one encounters in the mass production of the general run of consumer goods.

While the author has gone into considerable detail in description, this is warranted by the facts and gives the reader a clear insight into the various processes of manufacture. One notes, for example, that sewer pipe is "miked," that tools are chrome-plated for extended life, and that the "tool room" and maintenance department include modern machine tools and equipment. Taken as a whole, the article widens the already broad field in which tool engineers move.

Ed.

THE efficient, quantity production of Vitrified Clay Pipe, of good, uniform, high standard quality, depends as much on proper tooling as does the manufacture of steel products made with more intricate machine tools. Besides the machine tools used for maintenance and the construction of production dies and other units, there are tools of handling, tools of control, tools of production, tools of heating, and tools used in research for the improvement of the products.

Following is a description of the nature of these tools and allied equipments, the methods and materials employed in production, and the controls over them, in the main plant of Gladding, McBean & Co., Los Angeles, where Pottery, China, and Wall Tile are also manufactured in other sections of this, the largest ceramic plant in the west.

The clay used, in the vitrified sewer pipe discussed, is obtained from three different California deposits and is shipped in by freight car. These cars are spotted, for unloading, on a long spur with the plant on one side and an elevated track on the other. Beyond this track, in convenient locations, are two clay storage bins. At each location there is a large building, housing pipe-forming steam presses and allied equipment, also, large drying rooms.

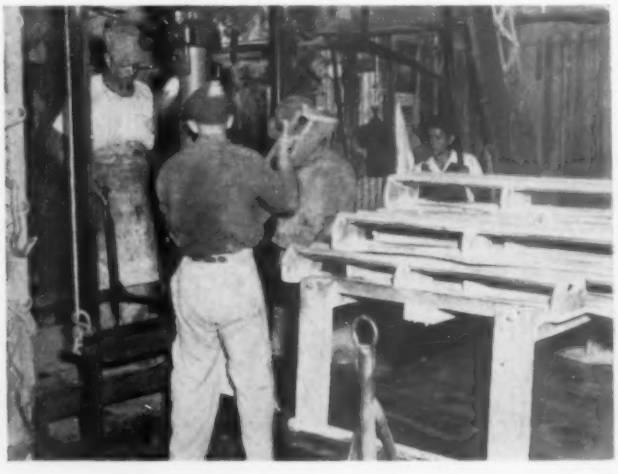
Fred M. Burt attended college in Ohio and West Virginia, and for a number of years has been active in sales, industrial and production engineering. Latterly specializing in promoting information in the technical fields, he is author of several hundred technical articles published in leading magazines.

A crane, with a ½ yard capacity clam shell bucket, has two functions: First, to unload the cars into the storage bins. Second, to pick up from the storage bins proper combinations of clay—so many buckets of this kind and so many of that—lifting the clay in a swing over both tracks and dumping it onto the sloping side of a hopper from where it slides to a slowly traveling, horizontal belt which carries it for discharge into dry pans. Each of the dry pans has capacity to thoroughly mix and pulverize about 8 tons of clay per hour. This mixture is carried by bucket conveyor for discharge on a screen above a hopper of about 70 tons capacity.

The screens average about 12 mesh, sometimes a little finer or coarser, depending on what is desired. Most of the clay passes through, with the remainder flowing by gravity back to the dry pan for further disintegration. In addition

The Pug Mill, showing knives and the clay being mixed under the cross rods at top of the tub.

Pressing 4" pipe. "Off bearers" shown removing pressed pipe (left background). In foreground, shop wagon and pipe cradles.



to the clay passing into the dry pan, the operator is continually shoveling in proper quantities of crushed vitrified clay. This is obtained from broken and imperfect pipe, previously made. The purpose of the inclusion, aside from the salvage angle, will be explained further on.

Extrusion Process Used

This dry pan operator is the first to be mentioned, of a crew of 13 (usually), working as a team at each press under the supervision of the press operator. One press—hereafter called No. 1—is used to make 4", 6" and 8" diameter tile, which comprises the largest portion of the demand and consequent production. Another press—hereafter called No. 2—is of much larger capacity and produces the smaller sizes, plus the larger ones up to the 36" size.

The clay for the hopper of the first press passes through a controlled, gravity discharge onto a 12" horizontal belt which dumps it into the tub of an extrusion or pug mill. A shaft in this tub carries knives which thoroughly mix the clay with water added by the pug mill operator, and in quantities that his experience deem to be proper. This mixture is picked up by an auger in the same horizontal plane, and fed into a de-airing chamber kept at a vacuum reading of 26-27" on the mercury column (absolute vacuum is approximately 29"). The vacuum on this and at the other de-airing chamber, which is a part of the steam press unit (Press No. 2) is created simply by sucking the air out with a small air compressor.

De-Airing for Strength

The pressure of the moistened clay being "screwed" into the chamber and the pressure of the clay as it is forced out the other end through a 10-inch square die, prevents admission of air to maintain the vacuum. The reason for the removal of air is that if any air pockets or laminations are present when the pipe is formed, they are likely to be weak spots in the completed and fired unit. As the clay enters the de-airing chamber it is further broken up by revolving shredder knives, thus it is certain that all air which might be carried in by clay particles or lumps will be sucked out.

The ten inch die, criss-crossed with wires, is used to cut the extruded clay into two-inch squares. As it is extruded, a cutting wire descends automatically to cut the two inch squares into two-inch cubes. These fall onto an ascending, slatted belt which carries them to the feeding hopper of No. 1 steam press. This extrusion pug mill can be used for forming drain tile, other hollow tile, brick and many other clay shapes, depending on the die used.

Making 4" pipe. Press in background, with wagon receiving pipe. Note "gage" for cutting pipe to proper length. In foreground, truing the socket end and scratching the spigot end.

The feeding hopper, to which the clay slugs have been carried, is equipped with a gate which the feeder opens by hand to allow a proper amount of slugs to drop onto a stationary, horizontal belt. When it is time to charge the chamber of the steam press, the feeder pulls a lever and the "fast belt" is instantly actuated to catapult the slugs into the chamber.

The steam press operates vertically, with the rest of the crew on the floor level below. At the top is the steam cylinder, which operates at a pressure of 125 pounds per square inch on a 44" diameter steam head—a total working pressure of about 95 tons. The lower end of the piston—or "mud" head is 20" in diameter. (22" diameter on the larger press). Beyond this point, the operating procedures are the same on both presses.

Forming Under High Pressure

At No. 2 press, the dry, pulverized clay is fed onto a belt somewhat larger than at No. 1. This drops the clay into a much larger pug mill which does not include the de-airing and extrusion features. This pug mill feeds the mixed and moistened clay down onto a slatted belt which carries it to a hopper at the press. Rollers at the bottom of this hopper turn slowly when actuated by a lever controlled by the feeder.

The turning of the roller drops the quantity of clay desired down into a chamber opened by the receding of a horizontal, steam ram 20" in diameter. The movement of this ram is controlled by the feeder with another lever. Its forward movement pushes the clay into the press de-airing chamber, differing in this respect from No. 1. The downward movement of the mud head through this chamber forces the plastic clay down into the forming die.

In making 4" pipe, underneath the press there is a lever operator. With a charge of clay in the chamber above and beneath the mud head, the lever man locks the "socket former," the die which forms the large—or socket end—of the pipe, which is raised up into the high position by counterweights running on two vertical guides. As he locks it by a movement of the lever, the press man, seated at one side, moves a lever to open the steam valve. This forces the clay under the high pressure down into the socket former dies.

This pressure continues until little streams of clay, like large spaghetti, flow out around through little "issue" holes to a length of two or three inches. This indicates that the socket has been formed. The press man then shuts off the steam to relieve the pressure and allow the lever man to release the socket former. The steam pressure is then applied again, after which the socket former drops down, carry-

Glazing the inside of 4" tile drain pipe with 360° sprayhead. DeVilbiss gun used, with nozzle mounted on a feeding rod.

ing the socket and the barrel of the pipe which is extruded as the pressure forces the clay through the concentric dies above.

When the socket former and end of the pipe reach a marked lower level, indicating that a proper length of pipe barrel has been formed, (a little longer than desired for the completed pipe) the steam pressure is again cut off. Then, the press man presses one of two buttons in the arm of his chair. This actuates a revolving, vertical shaft above, contained in the press housing and carrying two knives attached to the shaft at one end. The shaft is turned by a small reversible motor, above. As it turns, first in one direction, the knives fly out by centrifugal force and cut the pipe.

Operations Synchronized

This is done almost instantly, when the press man pushes the second button to reverse the motor which returns the knives to the "in" position. Then, the lever man pushes the pipe down a trifle farther so that its upper end clears the die. In the meantime, two "off-bearers" have placed a wooden cradle up against the pipe and, as it clears, they lift it off with the cradle and place it on the steel floor of a "shop wagon". By the time they get this done another pipe is ready, for, when everything is working smoothly, at least 250 pipes per hour are made.

The feeder has a foot treadle which sounds a buzzer below. When the clay in the press has been nearly used up, and the press man raises the piston, followed by the insertion of more clay by the feeder, the latter signals that operations can start. If something goes wrong, and he wants the piston raised or kept up, he signals intention.

A window in the No. 2 de-airing chamber enables the feeder to observe how much clay is in the chamber. Through long experience, however, these operators can synchronize their operations so that signalling is almost superfluous except when some untoward condition arises.

The 42″ x 90″ flat bottom of the shop wagon, 23″ above the floor, is carried on four springs on two axles carried by four 4.00 x 8, pneumatic tires. There must be no jarring! For the small 4″ pipes, which are laid on it crossways, a framework carries two levels and 18 pipes to the load. As each pipe is placed on the wagon with the barrel or "spigot" end away from the press, the eighth member of the crew (a cutter man) places a gaging form over the pipe and, at the end of it, slices off a piece with a wire cutter to give the pipe exactly the proper length. The small rings which he cuts off are tossed onto a conveyor which carries them back for re-use.

As soon as the truck is loaded, and the pipes cut, it is pulled out of the way to be replaced by an empty. In this new position, two other men—a scratcher and finisher—go to work on both ends. The scratcher runs a fork-like tool around the outsides of the spigot end, leaving parallel scratches around the circumference. This removes any lengthways deposits of clay that may be left. At the other end, the finisher runs a cutting tool around the socket end to trim it to proper shape. This is followed by a "scratching" on the inside circumference. When the finished pipe is laid, these scratches are opposite each other and help grip the joining cement at pipe joints.

The eleventh member of the crew uses an electric Mercury utility truck to haul away the completed truckloads to the drying rooms where there two floor men unload and place the tile for drying, thus freeing the wagons for return to the press.

When forming, as, for instance, 8″ pipe, a little different process is followed after the forming. These are loaded, ten to the wagon, in vertical position, resting on clay rings of proper height. These rings in the socket end are necessary as the thin section of the socket end would not sustain the weight without bad distortion.

Just before the pipe is cut by the knives, the lever man pushes the socket former down a short distance. The off-bearers slip a wooden pallet, carrying the ring, on top of the socket former which comes back to fit the ring into the socket end. Then, after the cutting, the socket former is dropped for clearance, the off-bearers lift the pallet, ring and pipe a few inches to one side, placing it on a roller conveyor which carries it a short distance to the level of the shop wagon to which it is transferred.

Bushings Chrome Plated

A major improvement was made in the pipe-forming dies when their bushings, (which are removable and form the wearing surfaces of contact with the forming clay), were hard chrome-plated .030″ thick. Previously, the cast iron bushings needed replacing after forming about 30,000 feet of pipe. With the chrome-plated bushings, on 4″ dies, they were removed after running 182,000 feet and "miking" showed a slight wear.

At 265,000 feet, the wear was a little greater and they were removed for re-plating at 554,000 feet of pipe production as they showed a wear-down to about .010 of plating thickness, and with some unevenness of surface. Another great advantage in the plated dies lies in the fact that even when the plating is nearly worn through, the pipe (4″) weighs the standard 31 lbs.

Exit end of 30 car tunnel kiln. Car shown coming out of the cooling zone is moving at about ½″ per minute.

Die bushings for Cordova roof tile, in which (center arrangement) the clay is extruded between two bushings to make 2 tiles. Bushings are chrome plated for extended life.

With the cast iron bushings the wear was such that, before replacement, the pipes often rose to 33 pounds in weight. Extra weight to be hauled and extra clay used.

This plating technique is being used on several varieties of wearing surfaces employed in clay products manufacture, or wherever it seems to be indicated for increased life and as fast as the applications can be made and tested.

The smaller sizes of sewer pipe are dried on "hot floors" made of cement with steam pipes embedded in them. They are dried very slowly for seven days. The floors are sanded, as the sand is a fine medium on which shrinkage may take place and the sand acting as ball-bearings to carry the slight movement. Pipes from 18" to 36" (inc.) are placed in humidity drying rooms about 45' x 45' holding about a kiln of ware. The floors (of wood) have slight interstices between the boards.

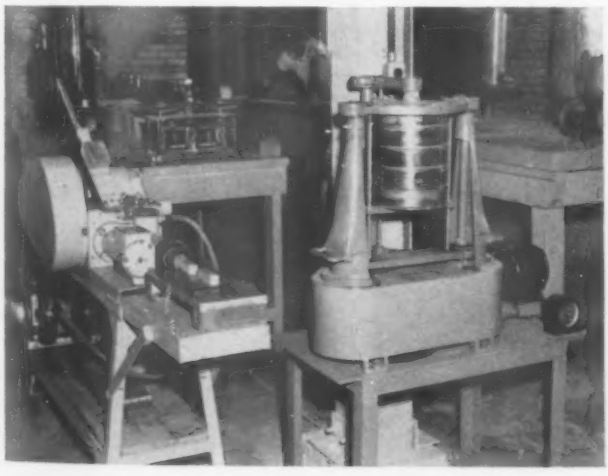
There is a hot air chamber underneath the floor into which hot air (into which steam is injected) is blown after being heated with a gas furnace. The chamber is kept under pressure and so arranged and regulated that at the start the air has a humidity about equal to that of the freshly made pipe. Then the heat is slowly raised and the humidity reduced to dry the ware in about five days. The maintenance of this humid atmosphere prevents the drying of an outer crust, making the drying even throughout the shell and thus preventing subsequent distorting or cracking. The air is recirculated, being picked up by vents of graduated size, high in the room, and passed back, by the blower, through the heating and steam injecting chamber.

Special Glaze Applied

As a great improvement over the old salt glazing of pipe surfaces, the dried pipes have their insides coated with a special ceramic glaze. Each pipe is coated with a glaze which has been calculated to have the same shrinkage properties as the pipe body. Thus, when it is fired in the kiln, the porosity-sealing glaze fluxes with the pipe and doesn't craze or chip. This glaze is applied by spraying.

A truck hauls thirty-eight 4" pipes to the sprayer, who has a steel barrel of the glaze which is kept in constant agitation. This is mounted on a lift-truck pallet, making the whole unit portable. After cleaning out the ends of the pipes with a spatula-like knife, he blows them out with compressed air and then starts the spraying. A 360-degree nozzle is mounted on a feeding rod and DeVilbiss gun. Under the gun is a little rubber wheel. The operator inserts the gun in the spigot end of the pipe and runs it to the other end and back, with the gun open and spraying. A whole truck load can be cleaned and sprayed in less than ten minutes.

View in Research Laboratory. Left foreground, Davis-Brown De-airing and Extrusion machine for making test bars. At right, Ro-tap machine with riddles.



Ten inch (and larger) pipe is fired in periodic, gas-fired kilns, 32 feet in diameter, but the big production is in two tunnel kilns. As soon as it can be installed, these will be supplemented by a much larger, 450 foot tunnel kiln. At present, the kiln used will hold 30 six foot cars. Ahead of that is a nine car capacity drying chamber heated with air-re-circulated from the cooling end.

The preheat zone holds 12 cars, six in the hot zone and 12 in the cooling end. A car travels its length of six feet every two and one-half hours. The heat is administered by under-car firing with eight natural gas burners on each side. A recorder-controller pyrometer is used, with the rhodium-platinum thermocouple close to the hottest spot in the hot zone.

Great Diversity of Tooling

The dies, and other tooling and equipment, are constructed and kept in working order in the large machine shop which contains seven engine lathes, 4½" to 44" swing, two milling machines, a Pratt & Whitney die sinker, a slotter, an abrasive surface grinder, a Blanchard surface grinder, an Oster pipe threading machine, two power hack saws, two flexible portable grinders, two pedestal grinders, two sensitive drill presses, two radial drills, a small hardening furnace and a full complement of hand tools and gauges. Tooling all over the plant and for other plants in the Southern Division, (a refractories plant in Los Angeles, another one in South Gate and a sewer pipe and drain tile plant in Santa Monica), is constantly being designed and improved in this machine shop. The diversity of tooling in all of these operations is great.

Next to the machine shop is the Research Laboratory. Its equipment includes a dry or wet pan, vibrator screen, mikropulverizers, a jaw crusher, a Ro-tap machine, a semi-muffle furnace, a pot furnace, an electric furnace (small), two de-airing and extrusion machines, a dough mixer, a filter press, jar mill rollers, a Simpson roller mixer, three ball mills, a hydraulic press, a dryer and other units including thermal expansion testing equipment. With the latter, as an example a piece of fired ceramic ware cut off 8" x ⅜" x ⅜" is placed in the inner cylindrical section of a vertical electric furnace.

The original testing temperature is set on the dial of an on and off switch and the heat is applied at that temperature and recorded on a pyrometric chart. On the top of the furnace is a dial. When its pointer makes a complete revolution, that indicates an expansion of 1/10". The dial is calibrated in 10 thousandths of an inch. The test piece is left at one temperature until the dial shows no further expansion, then the temperature is set for a higher heat and the added expansion is checked at that heat.

Laboratory equipment includes from left to right, dry or wet pan, Mikropulverizer, (to 200 mesh) and jaw crusher.

By D. B. Pratt

Army Hospital Tool Shop Adjusts Veterans to Industry

G.I. Students Learn by Doing in Well Equipped Plant That Simulates Industrial Conditions.

TOOL designing and metal working, as therapeutic agents, are being employed in the recently-opened, automotive-type tool shop operated by patients at Percy Jones Hospital Center, Fort Custer, Michigan. The huge Sixth Service Command facility accommodates 9,500 wounded, disabled and convalescent war veterans.

Actuated by the opportunity to promote education in the metal working field and to simultaneously aid in the rehabilitation of war-weary soldiers, members of the Automotive Tool and Die Manufacturers Association of Detroit, and their suppliers, have contributed approximately $50,000 in cash, equipment and materials for the installation. As soon as additional contributions are available, the Association plans to co-operate further in the Army Surgeon General's reconditioning program by installing heat treating and metallurgical departments.

Two 51 x 58 foot, former company mess halls of the World War I training camp have been fitted up as a machine shop, wood working shop for pattern making and a drafting room where GI students learn blue-printing, drawing and tool designing. Airy and well-lighted, the shops present a spic and span appearance. Prisoners of war constantly circulate about, cleaning, lubricating machines, and sweeping up litter and chips.

The all-new metal working equipment, augmenting that provided by the Army, includes milling machines, shapers, lathes, drill presses, surface grinders, tool grinders, filing machines, band saw, cut-off saw and a sander. There are two complete tool cribs, a fine selection of precision instruments such as Vernier height gages up to 12″, micrometers up to 6″, Johansson gage blocks, a Shadowgraph, a 5″ sine bar, and one of four existing models of a newly-developed sine plate not yet on the market.

Entrance wing of Percy Jones General Hospital, the former Battle Creek Sanitarium acquired by the Army as the first unit of a huge installation for the reconditioning of veterans. Below, tools, designed and made by patients, in Convalescent Hospital tool shop.

U. S. Signal Corps Photo.

Above. The Drafting Room. Below, Ray Dean, Head Instructor, coaches students in milling techniques.

Stock consists of 12 tons of cold-rolled steel up to 6" diameters, and quantities of plexiglass and lucite. The woodworking shop is equipped with 2 lathes, a drill press, 3 saws, a spindle shaper, a jointer and a sander.

Approximately 250 veterans are enrolled in the four daily classes of one and one-half hour periods. Frequently attendance runs so high that it taxes the facilities available, compelling students to wait for a turn at the machines.

Both army and civilian instructors, experienced in practical tool shop work and engineering, teach the students, who are free of military discipline during classes. Emphasis is placed on a normal, industrial shop atmosphere, providing gradual adjustment from military to civilian life.

Serving as a "finishing" school for patients who have been screened through other shops provided by the army, the pre-technical courses begin with training films instructing the students in the care and use of the valuable machinery and precision instruments.

Veterans may choose the types of machines which they wish to learn to operate, but work is usually begun on the shaper, followed up with the lathe, and finally the milling machine, if the student is apt and is enrolled for a sufficient time. Instruction usually extends over an eight-week period.

Mechanical drawing is part of the course, enabling students to follow through from layout, designing, and pattern making to the production of the completed article. Turning their hands from destructive to creative efforts contributes much to the well-being of the patients who are principally sufferers from "battle fatigue."

The kindly understanding of Head Instructor Ray Dean, formerly associated with American-Marsh Pumps, Inc., Battle Creek, Michigan, works wonders in the reconditioning of combat veterans. He likes to tell about the prospect who entered the shop listlessly, responding "None" to inquiries concerning his education and mechanical training. On the first day, the patient criticized a student operating a shaper incorrectly; the second day, he helped a learner on a milling machine.

On his third appearance, Instructor Dean improvised "a rush order wanted by an officer," and handed the job to the veteran to whom he appealed for assistance. The work was completed willingly, skilfully, and in record time and the shop gained another recruit.

At the end of two weeks the GI was granted a weekend pass to his home a few miles away—a privilege which his condition previously had prohibited. Within two months, the former artisan, who had in civilian life designed some of the very machines being used in the shop, was discharged from the hospital, fully recovered and able to return to his regular pursuit.

While attendance at classes is voluntary, unauthorized absences result in the forfeiting of weekend passes for which patients are eligible every seven days. Soldiers are required to account for a full-day of prescribed treatment and rest periods, but may be excused from classes upon their physicians' orders. Training films become doubly important in bridging gaps caused by such absences. New operations taught during the first two days of the week are carried out in actual practice on the three subsequent days.

Students "break in" on shapers and drill presses (above); and progress to lathe department (below).

Surface grinding (above) is another stage in progressive education. Below. The inspection department, equipped with the latest in precision instruments.

There is no cost to the student for materials which are supplied through the generosity of manufacturers, and the finished product is his to take home as a souvenir when he is discharged from the hospital. Patients make items for their own use, gifts for relatives and friends, and parts used in other rehabilitation programs on the seven-mile long military reservation, comprising some 1350 buildings.

Favorite projects include the making of machinists' hammers, screw drivers, punches, vises, clamps, V-blocks, rivet sets, adjustable wedges, bevels, drill blocks, angle irons, and key-handle wrenches.

Machined aluminum cigarette lighters and individually-designed plastic trinket boxes for feminine gifts are also popular undertakings. Mechanical skills thus acquired or re-acquired at one of the most advanced army reconditioning hospitals arm recuperating soldiers with new confidence to conquer the peacetime industrial world.

The first unit of the huge installation was acquired in August of 1942 when the government took over the luxurious Battle Creek Sanitarium, accommodating 2000 patients, renaming it Percy Jones General Hospital in honor of Colonel Percy L. Jones, the Army medical officer responsible for the organization of the AEF ambulance service in World War I.

Handicapped patients confined in this section also have opportunity to learn machine shop practice, mechanical drawing and tool design. In the first course, the soldier learns basic skills in machine shop practice through six projects. The second course requires the completion of eight projects, including the design and construction of tools such as calipers and ball peen hammers. In the third and most advanced course considerable latitude is allowed in the selection of individual projects.

Bedside courses in mechanics are taught by means of kits made up in the shop and sent to the wards. There are three automotive kits—distributor, fuel pump and carbureter, a Diesel kit containing an injection assembly, a mechanical drawing kit; two radio kits for construction of a three and a six-tube radio, and a wireless telegraphy kit for learning Morse code. Instructors visit the wards to help when needed.

In April of 1944, W. K. Kellogg's palatial summer home at Gull Lake was acquired as an annex. Three months later the next expansion took place in the old induction center area at Fort Custer where an advanced reconditioning section was formed. Subsequently enlarged and renamed Percy Jones Convalescent Hospital, this unit has a capacity of 6,000 patients. Late in 1944 the 1500-bed former Fort Custer station hospital was absorbed and re-designated Percy Jones General Hospital Annex. Consolidation of all the facilities, now known as Percy Jones Hospital Center with headquarters at Fort Custer, was effected last April.

By Filip Stad

New Light Sources for the Postwar

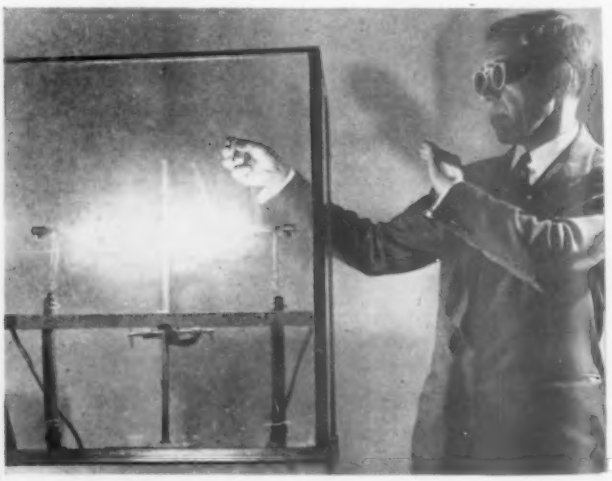
Interesting phases of future lighting have been precast by Samuel G. Hibben, Director of Applied Lighting, Westinghouse Electric Corp., Bloomfield, N. J. Among the many problems, receiving constant attention at the Westinghouse Research laboratories, are the very vital ones of transferring electrical energy to radiant energy without the intermediate step of heat. The objective, of course, is old, but several recent approaches are new and of great import to industry.

When the war began, about 95 percent of man-made light sources were tungsten filament lamps having their optimum economic light emission when the filaments were operated at temperatures approximately 3,000° K., and where the heat losses approached 90 per cent of the input energy. While this was patently unsatisfactory, considerable progress has been made since then.

In his search for ideal light sources, the scientist turns anew to study of the glow worm and firefly, of luminescent bacteria and chemiluminescence and bioluminescence in Nature. Most of Nature's lamps produce light by oxidization, without any waste of energy in producing invisible ultra-violet rays and practically none in heat radiation. The radiant energy from a firefly, for instance, is 90 percent luminous—closely approximating 500 lumens per watt. This is 10 times the ultimate efficiency of a tungsten filament lamp which, at its best, can generate only 35 lumens if operated over a period of time.

The "cold light" of a firefly reproduced in a pitcher by Mr. Hibben. The "cold light" is obtained by mixing phosphorescent liquids.

Of a brilliance one-fifth that of the sun's surface, this mercury vapor lamp generates sufficient heat to light a near-by cigarette. Picture taken through special filter.



Nature's lamps, then, lose little or nothing in emitting red or blue colors. On the contrary, man's illuminants generate both color and heat and, in the case of hot body—or incandescent—types, a great deal of light in the long and short wave ends of the visible spectrum. In addition to the infra-red and ultra-violet, this radiation is wasted as far as seeing is concerned.

From a study of the color response characteristics of the human retina, it may be concluded that the sodium vapor lamp—which concentrates practically all of its luminous output at a wave length of 5890A (lemon yellow)—would be the best light source for general purpose seeing. However, a study of this and other almost monochromatic lamps indicates a further difference between Nature's and Man's illuminants.

The purpose of the latter is to make surrounding objects visible, whereas Nature's lamps are primarily designed to serve as signals, markers, or lures. Man's seeing judgment depends to a large extent upon the color of the object being viewed; hence, a monochromatic source, with resultant distortion of color, fails to meet our broad criteria for the ideal illuminant of tomorrow.

When, however, the energy of electricity is employed to displace or excite the outermost electrons of the mercury atom within the commercial tubular fluorescent lamp, there is generated short wave ultraviolet radiations. When this radiation, in turn, upsets the normal atomic arrangement of the phosphor crystals on the inside of the glass tube, there is achieved a "short-circuiting" light making process—i.e., a considerable generation of heat is eliminated. By this method some 10 to 20 per cent of the input energy is converted to usable light—a considerable improvement but, to Westinghouse scientists, not good enough.

An arc discharge through high pressure mercury vapor, ranging from 1 to perhaps 80 atmospheres (commercially at about 3 to 5), develops luminous radiation at a commercial efficiency on the order of 65 lumens per watt. This is better, in Mr. Hibben's opinion, and further research will increase this efficiency in proportion as the temperature and pressure of the mercury vapor is increased. The problem, here, is the refractory characteristic of the container. Summing up, we then have this analysis:

1. Tungsten filament illuminants now developing some 15 lumens per watt and practically limited to 35 or to a theoretical and ultimate maximum 55.

2. The fluorescent lamp, now developing 45 to 60 lumens per watt and capable of doing roughly twice as well, as the technique of developing 2537 A ultraviolet from mercury vapor and of efficiently exciting phosphor crystals therewith is perfected.

3. High pressure metallic vapor discharge lamps now producing 55 to 70 lumens per watt and theoretically capable of going considerably higher in efficiency if refractory containers could be had so as to permit increases in temperature that accompany pressure beyond roughly 5 atmospheres.

These are some of the present day problems in lighting research that offer a challenge to the engineer who recognizes that postwar lighting requirements will demand vastly more artificial illumination than man has heretofore enjoyed.

Carbide Blanking and Forming Dies

While Not New, in the strict sense, a line of Sintered Carbide blanking and forming dies, product of Firth-Sterling Steel Company, McKeesport, Pa., is nevertheless a recent wartime development. These dies—known as Diecarb—have been undergoing tests for several years on critical war work, and are now available to industry for postwar manufacture of consumer goods.

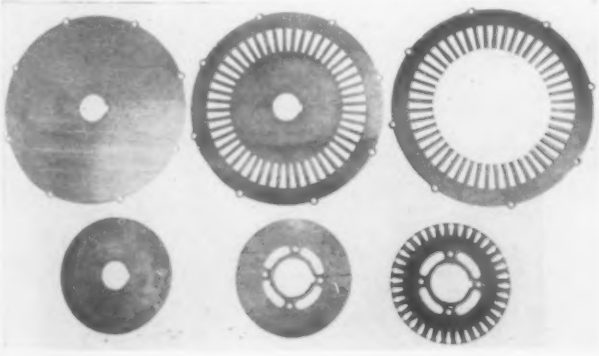
The dies make use of sintered carbide insert combinations, having a hardness from 65 to 73 Rockwell "C," depending on grade, and actual performance give best indication of their utility. As an example, a disc or "cookie" die, approximately 4″ in diameter, has been in use over a period of several years blanking a circle of silicon electrical sheet .025″ thick. At latest count, the production run had exceeded 500,000,000 stampings. And silicon sheet is tough on dies!

In a midwest plant, another Diecarb die had been used for stamping out E laminations for transformers, out of .025″ sheet. To date, this die has produced over 1,300,000 pieces *without regrinding* and without development of cutting burrs. So far, no statement can be made regarding ultimate life since each die, so far manufactured, is still in use or in operating condition. Even the "breakdown" point—i.e., the point where regrinding becomes necessary—is indeterminate for similar reasons.

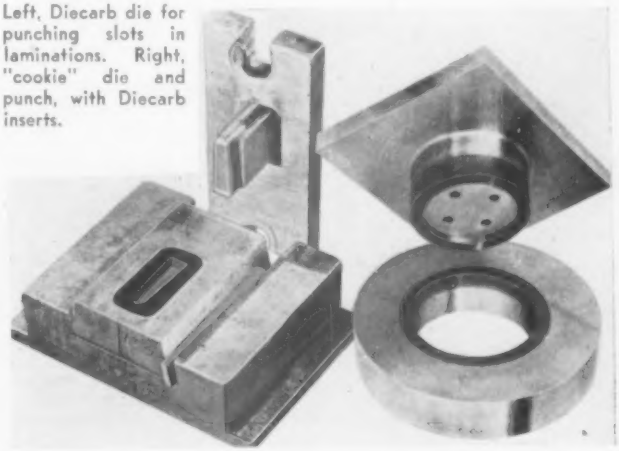
In the upper photograph is shown stator and rotor laminations punched with those dies. Top row shows, from left to right, a stator blank made from silicon electrical sheet, the blank as punched on an indexing press, and (right) the finished lamination with center removed. Lower row shows the progressive steps in rotor stock, with index notching.

The lower photo shows, left, a single-slot die for punching slots in laminations, and right, a "cookie" die and punch. The Diecarb inserts are readily distinguishable in the latter die—as inserted rings as the punch and die—and are also discernible in the lamination die.

Top row, stator laminations; Bottom row, rotor laminations.



Left, Diecarb die for punching slots in laminations. Right, "cookie" die and punch, with Diecarb inserts.



by Hal Lanning

Internal Pressure Chart for Steel Tubing

This diagram—or chart—should prove of interest and value to engineers and designers upon whom falls the burden of responsibility for safe working pressures in steel tubes. Prepared by Benjamin Ostlind, Staff Engineer for the Baker Steel & Tube Company, Los Angeles, Cal. it shows the safe working pressures for round steel tubes up to 10" O.D., of wall thickness from .035 to 1", ultimate tensile strength of steel from 40,000 to 100,000 p.s.i. and safety factors from 2 to 6.

For the purpose of plotting the wall thickness, curves on the chart the values of P—or ultimate pressure—were calculated for each thickness and outside diameter by each of the six most frequently used formulas—i.e., the "Common", "Barlow", "Boardman", "Mean Radius", "Lame" and "Clavarino." Then, the average result of the first two named—or "thin tube" formulas were compared to the average result of the last four—or "thick tube" formulas—and, in each case, whichever was the lower was used in plotting the curves.

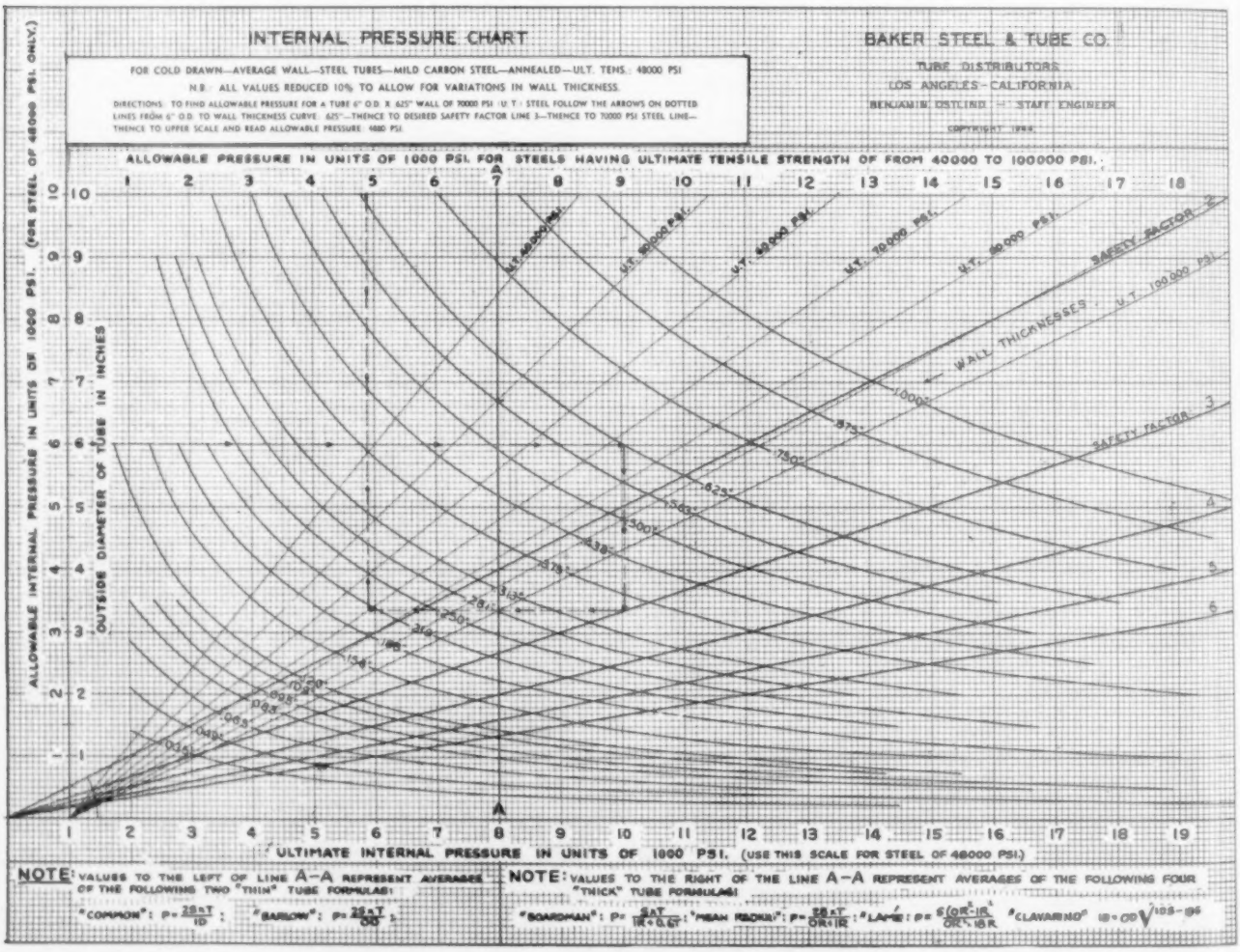
It may be of interest that for all values of P, equal to or less than one-sixth of ultimate tensile stress, the average of the thin tube formulas were the lower, while for all greater values of P the average of the thick tube formulas were the more conservative. The dividing line is marked A-A on the chart.

The diagram was primarily designed for low carbon, soft annealed steel having ultimate tensile strength of 48,000 p.s.i. and the calculations were based on Cold Drawn, average wall steel tubing and the values of ultimate tensile strength were reduced by 10% to compensate for a possible variation in wall thickness.

The diagram permits direct reading, by means of horizontal, vertical and radial lines, of the safe allowable pressures. There are two scales—a lower for steel of 48,000 p.s.i. and an upper for steels from 40,000 to 100,000 p.s.i. There is also a vertical dividing line—A-A—which differentiates between "thin tube" and "thick tube" formulas.

While an example for calculation is worked out on the chart, it may not be amiss to repeat it here, with necessary clarifying comments. Example:—To find allowable pressure —for a tube 6" O.D. x .625" wall of 70000 p.s.i. (ultimate tensile) steel follow the arrows on dotted lines frim 6" O.D. to wall thickness curve: .625"—thence to desired safety factor line 3—thence to 70000 p.s.i. steel line—thence to upper scale and read allowable pressure: 4800 p.s.i. For intermediate values interpolate between lines or curves, but on horizontal or vertical distances only.

Reproduced by courtesy of the Baker Steel & Tube Company, Los Angeles, Cal.


INTERNAL PRESSURE CHART
FOR COLD DRAWN—AVERAGE WALL—STEEL TUBES—MILD CARBON STEEL—ANNEALED—ULT. TENS.: 48000 PSI
N.B.: ALL VALUES REDUCED 10% TO ALLOW FOR VARIATIONS IN WALL THICKNESS.
DIRECTIONS: TO FIND ALLOWABLE PRESSURE FOR A TUBE 6" O.D. X .625" WALL OF 70000 PSI ULT. STEEL FOLLOW THE ARROWS ON DOTTED LINES FROM 6" O.D. TO WALL THICKNESS CURVE .625"—THENCE TO DESIRED SAFETY FACTOR LINE 3—THENCE TO 70000 PSI STEEL LINE—THENCE TO UPPER SCALE AND READ ALLOWABLE PRESSURE 4800 PSI.
BAKER STEEL & TUBE CO.
TUBE DISTRIBUTORS
LOS ANGELES - CALIFORNIA
BENJAMIN OSTLIND — STAFF ENGINEER
COPYRIGHT 1944
ALLOWABLE PRESSURE IN UNITS OF 1000 PSI FOR STEELS HAVING ULTIMATE TENSILE STRENGTH OF FROM 40000 TO 100000 PSI.
ALLOWABLE INTERNAL PRESSURE IN UNITS OF 1000 PSI. (FOR STEEL OF 48000 PSI. ONLY.)
OUTSIDE DIAMETER OF TUBE IN INCHES
U.T. 100,000 P.S.I.
U.T. 80,000 P.S.I.
U.T. 60,000 P.S.I.
U.T. 48,000 P.S.I.
U.T. 40,000 P.S.I.
SAFETY FACTOR 2
SAFETY FACTOR 3
SAFETY FACTOR 4
SAFETY FACTOR 5
SAFETY FACTOR 6
WALL THICKNESSES
ULTIMATE INTERNAL PRESSURE IN UNITS OF 1000 PSI. (USE THIS SCALE FOR STEEL OF 48000 PSI.)
NOTE: VALUES TO THE LEFT OF LINE A-A REPRESENT AVERAGES OF THE FOLLOWING TWO "THIN" TUBE FORMULAS:
"COMMON": P = 2St/D ; "BARLOW": P = 2St/OD ;
NOTE: VALUES TO THE RIGHT OF THE LINE A-A REPRESENT AVERAGES OF THE FOLLOWING FOUR "THICK" TUBE FORMULAS:
"BOARDMAN": P = St/(R + 0.6t) ; "MEAN RADIUS": P = 2St/(OR + IR) ; "LAME": P = S(OR² - IR²)/(OR² + IR²) ; "CLAVARINO": P = OD √((108 - 196)

Vilmers Borg

Automatic Control in Foundries

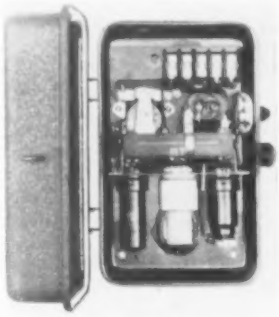
Automatic control of pouring operations in foundries, with increased safety, higher efficiency and closer control of quality, is now made possible by a unique application of the "electric eye." The control medium used is the Photoswitch Photoelectric Control—Type A-20-C—a product of Photoswitch, Inc., Cambridge, Mass.

Until the introduction of this modern system of control, which regulates pouring of metal, checks gas density and liquid turbidity and provides level and interface control, molds were individually poured from manually operated buggy ladles. As a result, operators were subjected to intense heat besides being in constant danger of burns.

With the aid of the "electric eye," however, pouring is controlled from a remote station, with one operator pouring several molds, simultaneously, in less time than was formerly required for several men. In addition to saving time and effort, previous hazards are eliminated.

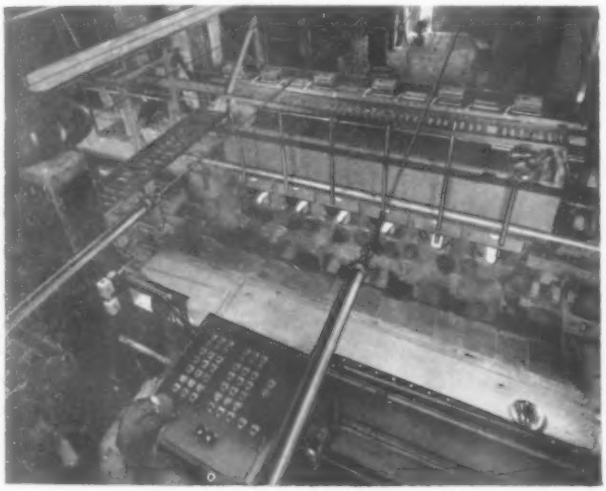
In operation, each of a group of empty molds moves into position before a ladle, with the "eye," watching through a viewing tube, mounted directly above. Then, with the molds in place, the operator tips the ladles of molten metal by means of push buttons which control the hydraulic actuating mechanism. As the white-hot metal flows into the molds, and reaches the riser of each, a brilliant white light is thrown off—a signal to the "eye" that the mold is full. At that point, the ladle automatically tips back, when the flow stops.

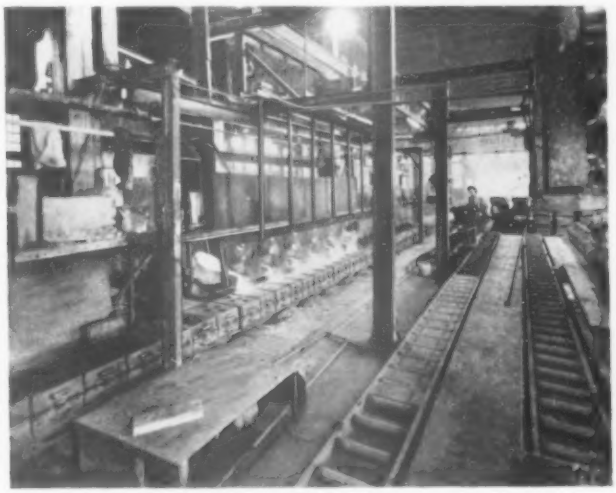
The "eye" is extremely sensitive, and provided with adjustment so that control will remain inoperative at one level of illumination, but will be activated when a slightly varied amount of light reaches the phototube. As a result, it may be used to indicate and control the density of gases as well as the turbidity, in liquids. In addition, it can distinguish between a clear liquid, such as water, and air above it, or it can detect interfaces between liquids having slight differences in translucency. Because of this sensitiveness, it has an extremely wide range of use entirely outside of its application in the foundry.



The Photoswitch

The photographs show installations at a plant of American Brake Shoe Company, where, with the help of six Photoswitch "electric eyes"—plainly visible at top of furnaces—one man now pours six ladles of molten metal in less time than was formerly required to pour one by the old method.





British Industry Gears for Postwar

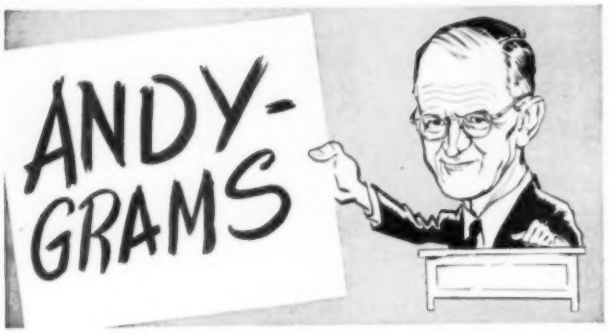
For British Engineering, and British industry in general, the abrupt ending of the war intensified industry activity. Methods developed in winning the "scientists' war" are now being employed to win the peace. A few of many purely civilian applications are briefly described below.

A Miniature drill, produced in England, for use by watch, clock and instrument makers and optical workers is 10" high and weighs 10 pounds. It is a high speed tool with capacity for fractional drill sized up to 7/64".

On the other extreme, a lathe for machining turbine rotors swings 13'6" and takes work 40 feet between centers. Built by Craven Bros., Manchester, with totally enclosed headstock, this machine is declared by U. K. engineering authorities to surpass all previous types. A Universal milling machine, by a Leeds firm, and a guillotine shearing machine which cuts mild steel ½" thick up to 8 ft. wide—made by J. Bigwood and Sons—are also among the new. This machine has unusual features and is designed for long years of continuous service.

In the quality control field, one notes a new precision instrument—the P.V.E. Surface Finish Analyzer—which, designed for visual use, incorporates a light source, an optical system and a reference lens in one unit. By this means, use is made of the interference of fringes of light for producing a series of bands which exactly follow minute differences present upon the surface being tested.

Also, a vertical Micro-Optic measuring machine, recently produced in Britain, makes direct measurements from zero to 4 inches, with reading by estimation to .00001". The British Engineering Journal states that the accuracy depends on a precision glass scale that is unaffected by wear.



WELL, HERE IT'S FALL again, and my crops are harvested—and eaten, which disposes of any problem of winter storage. At that, the gardening was fun and good exercise, even if the spring frost nipped most of the grapes and the robins took their share of the strawberries. Hope springing eternal and all that, we'll try again when the snows melt.

The melancholic days seem rather cheery now that so many of the boys are coming home. Yet, lest we forget, there is a legion that won't come back, but these are among the immortals, to live as long as the beacon of freedom throws its light over the world. In my immediate circle, however, my nephew—Wesley Rylander—came home a few days ago, with my son-in-law, Bud Mogford, hard on his heels.

Bud, who had seen plenty of action, presented me with a German rifle in practically mint condition. And there was a case for comparison! Where the rifles furnished our boys had walnut stocks, smoothly finished and oiled, and with trigger guards and bands nicely finished from forgings, the German gun had a stock of semi-soft wood with every tool mark showing. No oil or varnish, and the wood so rough that one expected a skinful of splinters from a pass of the hand.

Bands, holding the stock and barrel, were of the crudest strap iron, and the trigger guard, magazine, butt-plate and other accessories of rough stamped steel, spot welded into assemblies. However, the barrel was carefully made and of good design, and demountable in a matter of seconds. At that, the stampings indicated excellent die design; apparently, the Germans made the best of their dwindling resources. But, I don't blame their soldiers for throwing down their guns. Just no pride of ownership whatever.

ONE THING that puzzled me, during the early days of the war, was the "why" of the bayonet. I figured that if I were on the firing line, and a gang came for me with fixed bayonets, I'd just plug 'em before they got within sticking distance. And, from all I can gather, both our boys and the enemy soldiers threw their bayonets away as so much useless encumbrance. As Nason wrote in his story of *Sheehan* (World War I) they "vas chust goot to slice bread mit."

AT THIS POINT, my personal thanks to Hayden Shearer for his kindly comments concerning me in the Indianapolis Chapter bulletin. On behalf of the editorial staff, thanks a lot! Well, Hayden's quite a guy himself, and I imagine that he is as well liked among his Chapter fellows as he is among the Directors. But then, he's a typical A.S.T.Eer—fine fellows all.

Personally, I've had my nose too close to the desk, the past nine months, to closely follow Society events. Just a race to keep up with the deadlines! But, I repeat what I said a while back; that for balance, our present Directorate and Executive Committee is the best we've had yet. And, there are so many good men standing in the wings, awaiting the call to enter the stage, that I hesitate to mention names.

However, there's Atty. Gen'l Irwin Holland, who has done an outstanding job on Const'n and By-Laws, and Canada's Bill Dawson who has not only shown remarkable executive ability but has made his mark in committee work. Incidentally, he has written a Master Mechanic's Manual that makes mighty *Good Reading*. Then, there's Peoria's Carl Holmer who, like still water, runs rather deep. Carl is a quiet and clear thinker who, incidentally, is well versed in law. As a Society, we seem to have excellent material from which to choose future leaders.

From one thing to another, several of the boys have been mailing me catalogs and trade literature, with the queries "Andy, have you seen this?" and "What about trade lit?" Well, in the first place, I haven't seen all the trade lit by a long shot—it's coming in all the time—and in the second, we publish everything worth while in its turn. Can't turn the whole book into an index of folders. But, I wish the guys who send the stuff in would at least reveal their identities. Or maybe they think I'm a super-sleuth—one look at handwriting, and you know all about the writer! Heck! I've trouble enough reading my own longhand, once it's cold.

Walter Dimitruk, of New York Chapter, suggested a questions and answers column in the TOOL ENGINEER, to which, in turn, I suggested that he start it with a question. (I'm waiting, Walt). At that, I spend plenty of time answering questions, some of which entail considerable research if I don't happen to have the answer in my mental file. When a number of inquiries come in on the same subject, and from different sections of the country, we turn it into an article for everybody to read.

Take this *Fundamentals of Tool Engineering* department, now. Originally, it was intended for our juniors and, to give them a broader view of the vast field in which we operate, the subject matter deviated somewhat from the general run of metal processing. While our "juniors" have shown a lively interest, the surprising thing is the response from veterans in the game. Apparently, the department has served as a "refresher" course as well as an introduction to the more unusual techniques of metal processing.

I see by the A.S.T.E. News where Bill Smila is back as pilot of the Standards Com'tee, with Harold Johnson of G.M.C. as co-pilot. A good team, in my estimation. Bill having nursed Standards along in the wee-wee hours when it was just an infant in swaddling clothes. As for me, I'll treat on another bottle of Swedish punch just as soon as the imports start coming in—but, this time I'll portion out the drinks.

Speaking about standards, I've been buzzed plenty about a code of standards for carbide tools ever since we ran the article—Carbide Cutters, their Application and Selection—in the June TOOL ENGINEER. It seems that, out of some number of manufacturers of carbide tipped lathe tools, their product is superficially as alike as a podful of peas, only, there's no common denominator for grades. And that's what burns some of the boys up.

As a master mechanic, tool engineer or what have you prior to taking on this editorial job, I might have gone to bat on this, but in my present editorial capacity I'm entirely neutral almost. At that, I'm wondering. Y'know, there's never been an industry standardized yet but what everybody gained. Take ball bearings, f'rinstance. No matter what make you prefer, you can always get a replacement of another make if you can't immediately locate your favorite. And certainly, the ball bearing industry has lost nothing by standardization. Quite the contrary!

Andy

A.S.T.E. NEWS

NEWS OF INTEREST AND ABOUT MEMBERS

ASTE Members Want Data Sheets

Continued distribution of ASTE Data Sheets is overwhelmingly indicated in the returns from the National Standards Committee survey of the entire Society membership. Emphatically, also, members want an adequate index and cross-index to these sheets, issued semi-annually or annually.

W. H. Smila

The Committee's findings, compiled from questionnaires already received and tabulated, follow:

	YES	NO
1. Do you favor a continuation of Tool Engineering Data Sheets	93%	7%
2. Do you use the data sheets already published?	92%	8%
3. Do you think data sheets for machine tools (machines) should be given preference over data sheets for accessories, tools, gages, bushings, steels, bronze, carbides, etc?	47%	53%
4. Should dimensioned line drawings be given preference over photographs or pictures of the article being described?	82%	18%
5. Should any limit be placed on any manufacturer as to the number of data sheets issued by him?	30%	70%
6. Do you wish the data sheets to include the manufacturer's key for the interpretation of his catalog and product numbers for additional information regarding the product?	85%	15%
7. Do you wish the installation and/or operating instructions included in the manufacturer's data sheets?	64%	36%
8. Do you prefer that each manufacturer's data sheets be serially numbered as in Sweet's catalog?	73%	27%
9. Do you favor the publication of future data sheets in *The Tool Engineer* as an inserted sheet which can be detached and filed, rather than the present method of distribution?	40%	60%
10. Do you favor the issuance of an index for data sheets?		4%
(a)—Semi-annually?	50%	
(b)—Annually?	46%	
11. Do you favor the issuance of a cross-reference index, based on the manufacturer's name?	82%	18%
12. Do you favor a file number in place of the present system of indexing?	48%	52%

Proceeding on this mandate, the National Standards Committee has appointed a sub-committee which is now working on the preparation of an index.

Reporting further progress in the proposed standards committee program, Chairman W. H. Smila says:

"A plan has been evolved whereby future contacts with manufacturers wishing to use this service will be made through the Standards Committee of the nearest ASTE Chapter. Chapter Standards Committees will be empowered to make suggestions and give all possible assistance to manufacturers in planning proper Data Sheet contents and form.

"Final approval of Data Sheets will in every case be made by National Standards Committee members appointed for that purpose. A number of requests for data sheet service are already being handled by Chapters in various localities.

"Procedure manuals have been prepared and distributed to all Chapter Standards Chairmen, governing every phase of policy and procedure in future dealings with manufacturers participating in the Society's Data Sheet program.

"A contract form is being developed and will shortly be available, setting forth an equable schedule of charges to manufacturers using the ASTE Data Sheets Distribution Service.

"Rates for this co-operative service will be so established as to enable manufacturers to present their engineering data to the Society's membership at less than the cost of similar individual distributions."

Members who have not yet returned their questionnaires are requested to do so at once, so that the survey will indicate the wishes of the majority.

Hamilton Announces Junior Program

Hamilton, Ont.—A series of six technical sessions designed to interest Junior Members is being planned by Hamilton Chapter's Education Committee under the Chairmanship of R. T. Vincent.

Scheduled for Friday evenings in November, February and March, the lectures will not conflict with regular Chapter meetings.

Opening at 8 P.M., the sessions will continue for about an hour and a half, with opportunity to present problems for discussion.

The November program will include "Boring Bars, Drilling and Boring Tools," to be presented by S. A. Oliver of Otis-Fensom Elevator Company on the 16th; "Types of Milling Cutters and Their Uses," by G. Gilmour of Otis-Fensom, November 23; and films on Grinding Cutters, with a commentary by a speaker from Norton Company, on the 30th of the month.

On February 15, 1946, "Taps, Dies, Chasers," or "Tool Hardening and Chromium Plating" will be discussed by a speaker from Pratt & Whitney. A representative from Steel Company of Canada will explain "Cold Heading and Wire Drawing," February 22. "Economics of Tool Planning" is the topic assigned to W. J. W. Reid of Otis-Fensom for the final meeting on March 1.

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Annual Scholarship Prize Incentive In RIT Course

Rochester, N.Y.—A scholarship, to be awarded annually to a Rochester Institute of Technology student in Tool Engineering, has been established by Rochester Chapter, ASTE.

Sherman Hagberg

Based on superior first-year work both in class and in the co-operative industrial course, the award will go to a second-year student from within the Rochester Chapter area, the Institute making the recommendation.

Development of the plan was a project of the Chapter Scholarship Committee composed of: Second Vice Chairman Milton L. Roessel, Education Chairman Sherman Hagberg and Herman Martin, members of the faculty of RIT; Utility Chairman Earl Gruendike, and Fred Darling.

A pioneer in co-operative education for over a quarter of a century, the Institute, through its plan of alternate ten-week school and work blocks, provides a program of individualized education in which students may correlate theory and practical job experience. Wages for employment during work periods make the courses partially self-sustaining.

The new, three-year co-operative course in Tool Engineering offered this semester by RIT was organized with the assistance of the Society's National Education Committee and Rochester Chapter. First-year studies in the curriculum include: Mathematics, Mechanical Drawing, Machine Shop, Psychology, Mechanics and Heat, English, and Study Techniques.

Second-year students receive instruction in Economics, Drawing, Mechanism and Elementary Tool Design; Mathematics, Strength of Materials and Metallurgy, Tool and Die Making, Electricity, Foundry Practice and Process Engineering.

Production Planning, Optics and Sound, Tool Design, Materials Laboratory, Industrial Management, Tool Engineering Costs and Control, and Process Engineering comprise the subjects completing the three-year, practical course.

Dr. Mark Ellingson, President of RIT, was a speaker at the Tool Engineering Education Session of the Society's Semi-Annual Meeting held at Syracuse last October, discussing "Education For Reality," a plea for functional training in institutions of higher learning.

Van Amber Superintendent Of Machinery Concern

Albany, N.Y.—Charles F. Van Amber has joined the Frederick Streck organization as Superintendent, supervising the Rebuilding Shop and design of new machines.

For the past four years, Mr. Van Amber has been Supervisor in Charge of Machine Tools and Equipment for the New York State Department of Education. Previously he had been associated with Crouse-Hinds Company, Brown-Lipe Chapin Company, Brown-Lipe Gear Company and Vulcan Die Casting Corporation, all of Syracuse, New York.

Now a member of Schenectady Chapter, ASTE, he was earlier affiliated with Syracuse Chapter.

Dues Not Tax Exempt In Canada

Ottawa, Ont.—The Department of National Revenue, Taxation Division, has notified the Society's attorney, David E. Roberts of Detroit, that membership dues in a trade association or professional Society, such as ASTE, are not deductible from Canadian income tax returns.

The Department's decision follows: "It has been a long established practice with this Division to tax salary or wages without allowance for expenses incurred in the earning of that salary or wages. This practice has been upheld by a decision of the courts. When the taxpayer is working on a commission basis certain expenses are allowed, but in the case of no profession or trade have we allowed fees paid to a society such as the one you refer to."

This decision was rendered in response to Mr. Roberts' inquiry concerning the taxation status of Canadian members of ASTE.

Karash Lectures On Tool Design

St. Louis, Mo.—J. I. Karash, Plant Engineer, Reliance Electric & Engineering Company, Cleveland, was the principal speaker at the September 6 dinner meeting of St. Louis Chapter.

J. I. Karash

Mr. Karash, who is Chairman of Cleveland Chapter, ASTE, and author of the new textbook, "Drill Jig Design," talked on the "Design of Tools For Inclinable Punch Presses," a slide-illustrated lecture.

Fred M. Karches, Director of Operations, Rice Stix Dry Goods Company, gave some valuable pointers on promotional activities for publicizing the Society.

Intricate Machinery Seen In Brewery Tour

Milwaukee, Wis.—A tour of the Schlitz Brewing Company, September 13, opened Milwaukee Chapter's fall season.

In the late afternoon, members were conducted in small groups through the mixing rooms, the cooling rooms, the storage or aging rooms, and the barrel and bottling houses. In addition to the buildings used in the manufacture and processing of beer, the visitors inspected the engine rooms and the compressor rooms in which the refrigeration machines are mounted.

Of great interest to the ASTE'ers was the bottling house where precision timing and accurate handling of the bottles is controlled by conveyors and multiple operation machines.

At the conclusion of the tour, the groups gathered at the Schlitz Brown Bottle for dinner, following which Dr. James Lawrie, Director of Research for the Schlitz Company, discussed "Tools Of The Mind." His remarks concerned the basic senses and their utilization to the fullest extent.

A technicolor film, "South Of The Border," concluded the program.

Coming Meetings

ELMIRA—Nov. 5, "Ladies Night," Mark Twain Hotel. Speaker: Dr. Hilton Ira Jones.

TOLEDO—Nov. 14, Toledo Yacht Club. Speaker: J. L. Gruber, Formica Insulation Company. Subject: "Laminated Plastics."

TORONTO—Nov. 12, Malloney's Art Gallery. Speaker: R. A. Schafer, Development Engineer, National Automatic Tool Company, Inc. Subject: "Multiple Spindle Drilling Operations and Tooling Technique."

Indianapolis Co-operates In Rehabilitating Vets

Indianapolis, Ind.—Efforts to assist in the rehabilitation of war veterans interested in the metal working field have been initiated by Indianapolis Chapter.

According to the September issue of the Chapter's monthly bulletin, a suggestion was made by Paul Cave and Marshall Rosenbarger that convalescents in local army hospitals be invited to attend Chapter meetings. A subsequent invitation, extended through Captain James E. Nagle, Captain CAC, Chief Reconditioning Service at Wakeman Center, was promptly accepted with the result that five veterans will be guests of the Chapter at each meeting.

The announcement concludes: "By this method we will be assisting these boys in finding a place in this type of work in the postwar era, and either Chapter 37 or the local Chapters in these veterans' home cities will have an opportunity of extending a helping hand with their rehabilitation in conjunction with army regulations, after their discharge.

"You, as a member of this organization, should put forth an effort to make these boys feel welcome and at home; so introduce yourself to them, as they will soon be taking their place in industry."

The same issue carries a message from Regional Director Hayden R. Shearer of Indianapolis, calling attention to the development of the various departments of *The Tool Engineer* since the Society assumed its publication.

International Harvester Promotes Brown

Richmond, Ind.—L. G. Brown, who has been until recently on a special assignment to the Superintendent of the local plant of International Harvester Company, has been promoted to the position of Assistant Superintendent.

L. G. Brown

Mr. Brown has had wide experience in various capacities and plants of the company since 1927. During 1944 he was loaned for several months to the Rossford Ordnance Depot, Toledo.

He is affiliated with Richmond Chapter, ASTE, and served as Chairman of the Editorial Committee during the 1944-45 season.

Invalid Tool Maker Helps Win War

Buffalo, N.Y.—Determined to use his mechanical skill in the prosecution of the war effort though hopelessly invalided, Andrew Galles, paralyzed tool maker, has found compensation for his efforts, in physical and spiritual strength, mental relaxation, and financial independence. His achievement, reported by Buffalo Chapter, ASTE, through Allan F. Wegener, Engineering Division, Beals, McCarthy & Rogers, Inc., a personal friend of Mr. Galles, follows:

"Andrew L. Galles, considered a hopeless case by medical science, has turned out thousands of small precision parts and tools to aid in our war effort. His story should prove of vital interest to returning service men who are incapacitated and to the Tool Engineers who will want to assist these men to gain positions of value to their companies and to re-establish themselves in their respective communities.

"Mr. Galles, a former tool maker, suffered a fractured spine as a result of the Lexington Hotel fire in Richmond, Virginia, in February 1922. He was left hopelessly paralyzed and unable to work at his trade after spending months in various clinics and hospitals and undergoing three operations. Passing his days lying in bed or sitting in a wheelchair, Mr. Galles operated successfully a Christmas and greeting card business by mail, until our entry into the war.

"But let Mr. Galles tell in his own words of his venture into the machine and tool field.

"'I'm not sure just what made me take up mechanical work after nearly a score of years away from it, other than the fact that I was inspired to do something to help the war effort so that our armed forces would be equipped and kept supplied with the necessary implements to win a speedy victory.

"'After purchasing about $500 worth of machine and hand tools, I wrote to several prime contractors giving a brief outline of my set-up and of my former experience and they all responded favorably. Yes, it is true that at the start I drove my body to more aches and pains than I could endure and after a total time of two hours a day in my wheel-chair, I had to take to my bed. Gradually I built up this time at work to four to six hours daily at the machines, and the amazing part of it all was the enjoyment I got from my work and that I became physically stronger, more relaxed mentally, and stronger spiritually.

"'As I became acquainted with the work, I was later able to take on help to do the heavier physical efforts and busy myself with setting up, inspecting and generally managing the shop as well as working up new time-saving devices on jobs calling for close tolerances. Additional machines and hand tools were added until my shop contained two bench lathes, one hand screw machine, four drill presses, a tapping machine, and numerous hand tools, all set up neatly in a room about 10 feet by 22 feet.

"'My wife and two daughters, and two other girls, also operated the machines and are deserving of much praise for their inspiration and encouragement.

"'So this paralyzed and pain-racked body stood the test after being laid aside for many years. The most wonderful part of it is that I have really learned to live as a man ought to live if he can keep his mind and whatever is left of his body busy. I know this by actual experience.

"'If there are any more rewards coming to me this side of the Great Divide, I really pray that this personal testimony will prove inspiring to those who through injuries have been laid aside temporarily, to rise above themselves and make an honest effort to do something really worthwhile, by learning to live by re-learning to work, and to know that in spite of it all we can be useful and thereby be rid of that awful "washed-up" feeling tearing at our hearts.

"'IT CAN BE DONE!'"

Mr. Galles makes the setups necessary for the small turret lathes used in the shop by having the machines elevated sufficiently to roll his wheel chair beneath the bed of each machine.

Magnesium Symposium

Chicago, Ill.—A symposium on Magesium was conducted by the three guest speakers at Chicago Chapter's September 3 dinner meeting in Huyler's Restaurant.

Alfred B. Two, Technical Advisor, Revere Copper and Brass, Inc., opened the session with an address on "Magnesium Alloys and Their Uses." Explaining the methods for using magnesium in everyday manufacture, he also quoted statistics concerning the rise in importance of this new metal.

"Magnesium Alloys—Their Fabrication and Properties" was next presented by William R. Caple, Chicago Representative, The Dow Chemical Company. The research required to develop better and less expensive magnesium alloys was reviewed by Mr. Caple in his description of their physical and chemical properties.

Dan W. Moll, Vice President and Treasurer, Hills-McCanna Company, Foundry Division, and Chairman of the Casting Division of the Magnesium Association, New York City, concluded the discussion with "Magnesium—Past, Present and Future." World War I uses of magnesium—then an expensive metal—were compared with its present increased applications resulting from lowered costs through improved production. The speaker also predicted new postwar uses of the light-weight metal. He illustrated his subject with an excellent film, "Magnesium—The Miracle Metal."

Attendance at the triple-feature meeting numbered 204.

Penal Institution Engineers Humans

Rockford, Ill.—Joseph E. Ragen, Warden, Illinois State Penitentiary, Joliet Branch, opened the 1945-46 series of Rockford Chapter's monthly meetings with an interesting non-technical talk on "Human Engineering," given September 6 at the Hotel Faust.

At the conclusion of his brief remarks, he showed motion pictures of the many phases of operating one of the world's largest penal institutions.

Andrew Galles, paralyzed from the hips down, operates this machine shop in his home at Buffalo, with the assistance of his wife and daughter (shown at left). Inspirational mottoes on the walls give him a spiritual lift.

Authorities Will Contribute To The Handbook

LEADING AUTHORITIES IN their respective fields continue to send ASTE their acceptances as contributors to various sections of the "Tool Engineers' Handbook."

Added to the list of those currently at work on specific assignments are:

F. P. SARACCO of the Product Engineering Department, Plastics Division, General Electric Company, Pittsfield, Massachusetts, has devoted the past eleven years to plastics engineering for his company.

F. P. Saracco

His comprehensive experience was gained in various departments and capacities such as laboratory control of varnish, resins and molding compounds; manufacturing of varnish, resins and compounds; pelleting of molding materials; assistant foreman in molding room; layout and installation of complete molding plant; and six years of product engineering, including parts design, tool design, tool and parts cost and parts manufacturing specifications for molding and finishing operations.

Under the General Electric Tool Apprentice System, Mr. Saracco has developed and taught evening courses in plastics manufacturing. He has also collaborated on technical articles pertaining to hard chrome plating of molds for plastics parts.

* * *

Beginning his industrial career with Westinghouse Electric & Manufacturing Company, E. Pittsburgh, Pennsylvania, soon after graduation from high school, G. J. STEGEMERTEN has risen to the post of Chief Consulting Industrial Engineer on the Headquarters Staff serving the entire company.

G. J. Stegemerten

While engaged in general machining, fitting and assembly work, the ambitious youth studied general engineering at Westinghouse Tech and Carnegie Tech Night Schools. During World War I he entered the Aviation service of the U.S. Army as a mechanic, returning to the Westinghouse Time Study Department at the close of the war. Three years later he was promoted to the position of Time Study Supervisor of the Controller Department.

Subsequently he held this position in various departments and was very active in installing the Standard Time System.

Later he was appointed Superintendent of Time Study, having charge of this phase of activities at the East Pittsburgh Plant.

Mr. Stegemerten is the author of numerous papers on wage incentives and related subjects, including a presentation of Job Standardization prepared for the Fourth International Management Congress held at Paris, France. He collaborated with S. L. Lowry and H. B. Maynard on the book, "Time and Motion Study and Formulas For Wage Incentives," and with Mr. Maynard on a book entitled "Operation Analysis."

As Manager of the Center Line Ordnance Division (Mich.) and Works Manager, Electric Appliance Division (E. Springfield, Mass.) Westinghouse Electric Corporation, JAMES R. WEAVER has played a vital role in the production of war materiel.

J. R. Weaver

Assigned to the Michigan plant in 1943 when its management was transferred from Hudson Motor Car Company to Westinghouse, Mr. Weaver formerly managed the Louisville Naval Ordnance Plant.

After completing his apprenticeship as a machinist, begun with Westinghouse Airbrake Company in 1915, he became a tool designer. During World War I he enlisted in the Navy, was commissioned an ensign, and served on the USS Connecticut. Returning to Westinghouse in 1919, he rose from Assistant Tool Superintendent, through Works Engineer and Superintendent of Mfg. Equipment, to Director of Equipment, Inspection and Tests, the position he held before going to the Louisville plant in 1940.

With termination of the Westinghouse operation of the Center Line plant, Mr. Weaver will devote his entire time to the management of the East Springfield division.

He has been affiliated with Pittsburgh, Louisville and Detroit Chapters, ASTE, serving as Pittsburgh Chapter Chairman, National Director, Vice President and President of the Society. He is also a member of ASME and the Engineering Society of Detroit.

* * *

Distinguished in the fields of industry and education, DR. HORACE A. FROMMELT heads the Milling Division (Milwaukee) of Kennametal, Inc., Latrobe, Penna.

H. A. Frommelt

Following his graduation from Iowa State College with the degree of B.S. in E.E., the young engineer became General Superintendent of the Tipton Power & Light Company at Tipton, Iowa. Meanwhile he continued his studies at Campion College, Prairie du Chien, Wisconsin, and at St. Louis University where he was granted his M.A. and Ph.D. Next came an assistant professorship in Mechanical Engineering at Marquette University, Milwaukee.

Several years later he became associated with the Falk Corporation, Milwaukee, as Superintendent of Apprentices, subsequently becoming Assistant Works Manager. Education still called, however, and he returned to Marquette University as Professor and Head of the Mechanical Engineering Department.

In 1940 he joined Kearney & Trecker, Milwaukee, directing the company's sales promotion. When the war production program was initiated, he planned and inaugurated the Milwaukee District Training Program. At the time he recently concluded his service with Kearney & Trecker, he held the post of Director of Industrial Research.

Dr. Frommelt is a regular contributor to leading technical publications, in addition to writing numerous monographs and pamphlets on milling and delivering annually approximately 25 lectures before technical and professional organizations, principally ASME and ASTE.

He is affiliated with the Milwaukee Engineers Society, ASME, American Society of Testing Engineers, Tau Beta Pi, Sigma Omicron and Milwaukee Chapter of ASTE.

A love of erudition is apparent even in his hobbies which include such subjects as Latin, Greek, religion and literature.

In "Who's Who In America" and "Who's Who In Engineering" Dr. Frommelt is also recorded as the translator of a number of German works and the author of "Church Property and Its Administration."

* * *

Active in Connecticut engineering circles, KENNETH F. THOMAS, District Field Engineer, Hartford Territory, SKF Industries, Inc., Philadelphia, is keenly interested in the promotion of engineering education and advancement.

K. F. Thomas

After receiving degrees of B.S. in Engineering and M.A. in Business Administration, conferred by the University of Pennsylvania, he did postgraduate work in metallurgy, as well as teaching evening classes in Fundamentals of Machine Design for his Alma Mater.

For three years Mr. Thomas was associated with Perkasie Silk Mills, Perkasie, Pennsylvania, as Plant Engineer and Assistant Superintendent. In 1935 he joined the SKF organization as Development Sales Engineer, first in the Textile Division and later in the field of Auxiliary Aircraft Bearings. Prior to his present assignment at Hartford, he spent several months in the company's laboratories. He has also collaborated in the preparation of a number of technical articles and papers.

Registered as a Professional Industrial Engineer in Connecticut, Mr. Thomas has held various offices in the Southern New England Section of SAE, the War Production and Engineering Council for Northern Connecticut, and Hartford Chapter, ASTE, of which he is now Industrial Relations Chairman. He served two terms as Chapter Public Relations Chairman and New England Area Vice Chairman of Public Relations.

One of his outstanding public relations efforts was the design and construction of a mechanical, illuminated ASTE map, on which Chapter cities, regions and areas, with a corresponding legend, were indicated by colored lights appearing in geographical sequence. Built for the 1942 ASTE War Production Conference at Springfield, Massachusetts, the large, electric map was subsequently exhibited in a number of Chapter cities.

A technical member of the Institute of Aeronautical Sciences, he is also affiliated with the Hartford Engineers Club.

BUY VICTORY BONDS

Accident Prevention Applied To Tooling

Binghamton, N. Y.—"Tool Planning For Safety" was urged by R. E. Frederick, Sr., Supervisor, Machine Maintenance Division, International Machines Corporation, Endicott, when he addressed Binghamton Chapter September 5 at the American Legion Hall, Johnson City, New York.

R. E. Frederick, Sr.

With the aid of specially - prepared charts, Mr. Frederick outlined the causes, results and prevention of industrial accidents. Opening his remarks with a breakdown of accident experience, he pointed out the injuries, deaths and economic loss in millions of man hours, resulting from plant accidents.

In a chart detailing the sequence of an accident, five elements were represented—the social environment and ancestry of the worker, his carelessness, physical and mechanical hazards present, the occurrence of the accident, and the subsequent injury. Removal of any one of the links in this chain of events would prevent an injury, the speaker said.

As only 25% of all accidents are caused by mechanical and physical hazards, while 75% are the fault of the victim, often through hereditary and environmental conditions, work habits can be modified only to a limited degree.

Touching upon psychology and psychiatry, Mr. Frederick explained human behavior and its relation to accidents.

Another chart dealt with causes of accidents occurring in the handling of dies, such as sharp edges, insufficient clearance (when punch is down) between punch and die holders, loose shanks, poor clamping, poor setup, poor planning as to size of press to be used, and clumsy dies.

Hazards prevailing in connection with jigs and fixtures include whirling jigs, poor back stops, insufficient clearance between drills and bushings, causing freezing; lack of keyways in fixtures, resulting in slippage and collision with cutters; insufficient chip clearance in base of jigs, poor clamping and poorly-designed cutters.

Analyzing a chart listing severe industrial accidents, the speaker gave a demonstration in poor purchasing for safety, then summarized the fundamental principles involved in accident prevention which is as applicable to tool planning as to other phases of industry.

An inventor of many outstanding safety devices now in universal use, Mr. Frederick is a Past Secretary of the Automotive and Machine Shop Section and Past Vice-President of the Power Press Section of the National Safety Council, Past President and founder of the Greater Endicott Safety Council, member of the faculty and special lecturer on Safety Engineering subjects for Cornell University, President of Broome County Industrial Safety Engineering Society, and Vice President, Endicott AAA Automobile Club.

At the conclusion of his address, two industrial accident prevention films were shown.

Anniversary Dinner Features Dr. Caton

Richmond, Ind.—An outstanding program commemorating the first anniversary of its chartering was staged by Richmond Chapter on September 11.

Featured speaker was Dr. John J. Caton, retired director and founder of the Chrysler Institute of Engineering, Detroit, who delivered his famous lecture, "Common Sense In Education," in his frank and humorous manner.

Rev. Frank C. Hurst of the First English Lutheran Church offered the invocation which preceded the dinner served by the Leland Hotel. Musical entertainment was provided by Jack Kurkowski and his Xylophone Band, a local organization which has traveled extensively throughout the Central States, playing to many Army Camps.

Representing Regional Director H. R. Shearer of Indianapolis, H. D. Hiatt of that Chapter briefly outlined the Society's history, aims and activities, followed by Lowell B. Penland, Richmond Chapter Historian, who reviewed the events occurring during the Chapter's first year of existence.

The anniversary meeting was attended by 75 members and guests.

Toronto Orders Projector

Toronto, Ont. — For several years members and friends of Toronto Chapter have been making contributions for the purchase of a film projector. Their cooperation has made it possible to order new, 16mm. sound-on-film equipment for use in the Chapter's educational programs.

Richmond Celebrates First Anniversary

1. Dr. John J. Caton (left) is congratulated by Meeting Chairman Robert A. Schafer on splendid address he delivered at September 11 Anniversary Night.
2. Part of the 75 members and guests who participated in the Chapter's first birthday celebration.
3. H. D. Hiatt of Indianapolis, representing Regional Director H. D. Shearer, relates Society's history, functions and objectives.
4. Jack Kurkowski and his xylophone band provide entertainment on the festive occasion.
5. Richmond Chapter's Executive Committee pose before flags of United Nations. Left to right: Second Vice Chairman Jesse Johnson; First Vice Chairman E. H. Granberry, Chairman Roland E. Lockridge, Treasurer Marvel T. Moore, and Secretary Floyd Sykes.
6. Roland Lockridge, Richmond Chapter Chairman, presides at First Anniversary Dinner.

THE P X

(Route 3
Greenville, Mich.)
France

Dear Sirs:

Thank you for the Armed Service membership card. It may have to take a lot of abuse before I'm thru with it.

I'm grateful to you for remitting my dues. Here's hoping that it won't be too far in the future that I can pay my own dues and get back to my work. I'm proud to be a member of such a fine organization as A.S.T.E. I gained some valuable information from your magazine and standard sheets. My wife is saving them for me while I'm away.

I just moved out of Germany and am in a staging area called Camp Lucky Strike at present. I expect to get a furlough home very soon now.

Yours truly,
Pfc. Raymond Russell
At Large Member

* * *

U.S. Naval Torpedo Station Annex
Production Engineering Dept.
Coddington Cove
Newport, R.I.

Dear Mr. Potter:

It was indeed a great pleasure to receive a gratis membership card for the duration from you. In effect, it is an act of good feeling and good will on the part of the A.S.T.E. and it gives to those in the service a feeling that they are not forgotten men. My sincere appreciation.

Sincerely,
W. A. St. Jean
Lieut., U.S.N.R.
Detroit Chapter

* * *

ASN 35238418
Co. D.—64th Bn.
Camp Wolters, Texas

Dear Sirs:

Received your letter informing me of my Armed Service status in our organization for which I thank you kindly. I meant to inform you sooner of my entry into service but neglected to do so.

In my spare time I have been working on an idea along the kitchen aid line. My design is held up at present for want of information on an electric motor. It requires a variable speed motor similar to ones used on kitchen mixers. Believe 1/6 or 1/8 H.P. will do the job. Any information or source of information along this line which you could supply me would be greatly appreciated. I need information on speeds, shaft and overall measurements, types of mounts, and prices.

Hoping to hear from you in the near future and thanking you for your letter and service status I remain,

Yours sincerely,
S/Sgt. Fred W. Loy
Dayton Chapter

* * *

U.S.S. Key West P.F. 17
c/o F.P.O.
New York, New York
At Sea

Dear Sirs:

In looking thru my old mail I came across a couple of letters from ASTE which I accidentally neglected answering. My address kept changing for quite some time, but now I finally have one which will probably be relatively permanent.

I am in the Coast Guard, and, against all previous training before the time I entered, I am now a radio technician but still have tool engineering on my mind. I was a member of the Buffalo Chapter which I was very proud of and still am.

My membership card was lost some time ago and I would appreciate a new one if possible. I have plenty of faith in ASTE and am sure it was highly responsible for the glorious outcome of the war.

Sincerely,
Donald E. Danielson, RT 3/c
Buffalo-Niagara Frontier Chapter

* * *

(39 Smithfield Road
Woonsocket, R.I.)

Dear Mr. Potter,

Some time ago I received my Armed Service membership card but as I've been rather busy I had little time to "drop a line." My membership in the A.S.T.E. is of great importance to me and I was glad to hear of the action taken in carrying the membership of those serving in the Armed Forces. Thank you.

C. I. Randall

Right now I am outside Manila in the Philippines and as far as I'm concerned, it isn't a place for a vacation. One thing that amazed me was how quickly the Filipinos recover—or attempt to recover.

The only building not a shambles was the Rex Theatre and so far they've had four symphonies. I've enclosed the program. The natives are very friendly and every afternoon at four they flood the camp with children selling fruit—eight bananas or a coconut or pineapple for 1 peso (50c).

Inflation has hit the island and a pair of leather shoes sells for 90 pesos ($45). About my biggest complaint is that we get no milkshakes !! That is a major calamity.

I am a gunner-navigator on the P-61's —the "Black Widow." We have a good ship and really have a time. One thing that I often think about as we fly—as a civilian I was a Tool Designer and helped design all the tools for the P & W engines that we now use. As we maneuver around I often think what would happen if an engine "conked out" —ours do seldom, almost never—so I feel quite proud that I've been on both sides of the P & W engines. This candle is terrible so I think I'll close. Thank you again and keep up the fine work of the A.S.T.E.

Sincerely,
Charles I. Randall
Little Rhody Chapter

* * *

[Editor's Note: The program referred to in Private Randall's letter is for the Fourth Symphony concert of The Manila Symphony Orchestra, presented by The U.S. Army Base X Athletic and Recreation Section and The Manila Symphony Society. The 80-piece orchestra, conducted by Dr. Herbert Zipper, rendered an evening of music by Tschaikowsky, Debussy, and Wagner. Listed as Honorary members of the Society are Mrs. Douglas MacArthur and Mrs. Sergio Osmena.]

Toledo Publishes Season Program

Toledo, Ohio — Program Chairman Valentine G. Kessler of Toledo Chapter has issued a cleverly-written, printed calendar announcing the season's events.

Scheduled for November 14, is "Laminated Plastics," the story of Formica, to be presented by J. L. Gruber. Fred R. Bokorney of the Gisholt Machine Company will explain "Recent Developments In Balancing Machines," December 12.

The first meeting of the New Year, January 9, will be devoted to the study of a home product, the Hydraulic Transmission, to be described by Albert H. Diemel of Spicer Manufacturing Corporation. John C. Straub and H. F. Moore of American Foundry Equipment Company will discuss "Shot Peening" the same evening.

February and March are reserved for Ladies Night and installation of officers, respectively. "Lubrication" will be the topic April 10, with Frank Ross of E. F. Houghton Company relating interesting applications in this field.

Technical meetings will be concluded on May 8 with an address by Fred W. Whitcomb, Deep Freeze Division, Motor Products Corporation. In June the annual outing will bring to a close the season's activities.

Added features for the various meetings include the presentation of the following films: "Highway To Alaska," "How To Machine Aluminum" and "Mine To Metal," "Carbon Black Treasure," "B-29's Over Dixie," "On the Air," and "Air Screw."

Technical sessions are to be held the second Wednesday of the month, while business meetings will take place on the fourth Wednesday.

Kennedy and Maloney In New AFA Posts

Chicago, Ill.—American Foundrymen's Association has announced the appointment of Robert E. Kennedy as Secretary Emeritus of the Association. The action, taken by the Board of Directors, is in recognition of his long and valued service as Technical Secretary and Secretary.

William W. Maloney, former Business Manager, has been elected to succeed Mr. Kennedy as Secretary. Mr. Maloney has been intermittently associated with the organization since 1922.

Research Develops High Speed Milling

San Diego, Calif.—Al Janke, Western Field Engineer, Cincinnati Milling and Grinding Machines, Inc., Cincinnati, was the speaker at a recent technical session conducted by San Diego Chapter.

His subject, "Researches In High Speed Milling," included an outline of the proper application of work to the machine, fixture design, and machine set up. Mr. Janke also discussed horsepower input and output of milling machines and the power required for using carbide cutters, showing motion pictures of negative and positive rake cutters.

John Engle, Chief Tool Designer, Rohr Aircraft, Chula Vista, gave an inspirational talk on the "Power of Tools" and the opportunity for Tool Engineers to make the world a better place in which to live.

Design Of Rubber Molds Poock's Topic

Columbus, Ohio—Tooling for the rubber manufacturing industry was thoroughly explained to Columbus Chapter by H. O. Poock, Inland Manufacturing Division, General Motors Corporation, Dayton, technical speaker at the September 12 meeting.

H. O. Poock

Mr. Poock, a Past Chairman of Dayton Chapter, ASTE, introduced his subject, "Molds As Applied To Rubber Products," with a film entitled "The Isle of Yesterday," showing the planting of rubber trees on the island of Sumatra, tapping for the crude latex, and its preparation for market.

In describing types of equipment used to mold rubber products, the speaker showed slides illustrating steam-heated platen presses for vulcanizing, intricate mold designs, and trimming designs. Designs for the molding of steering wheels and motor mounts were included in the presentation.

At the conclusion of the discussion, Mr. Poock and his assistants, Messrs. Hutchinson, Sparks, Vogel, Jones and Fair answered many questions from the audience concerning the various phases of rubber molding.

Following the adjournment of the technical session, Marine Sergeants Paul Curtiss and Alvin Backherns screened "Fury in the Pacific" and "The Battles For The Marianas and Tarawa."

Profilometer's Inventor Discusses Surface Finish

Rochester, N.Y.—Almost unlimited results in improving production and reducing scrap can be achieved when the Profilometer is used as a production checker for fine finish, according to Dr. Ernest J. Abbott, Manager, Physicists Research Company, Ann Arbor, Michigan, and speaker at the September 12 meeting of Rochester Chapter.

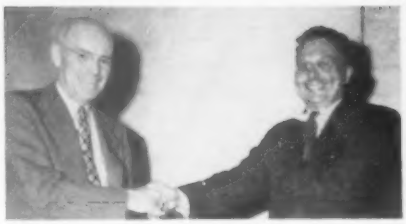
Used in the setup of a machine to start the job off properly, the instrument will continue to check at proper intervals, insuring uniformity throughout the run, Dr. Abbott, inventor of the Profilometer, stated.

Various modifications and ramifications of the instrument's applications were also discussed by the speaker in his slide-illustrated talk.

Long-recognized as a leading authority on the subject of measurement of surface roughness, Dr. Abbott has made a number of major contributions to the development of the science, winning wide distinction with the invention of the Profilometer. A consistent contributor to technical journals, he is well known in engineering circles.

Approximately 125 members and their guests attended the opening meeting of the season held in the main auditorium of Rochester Institute of Technology. Visitors included Past Chairman Stephen Urban of Syracuse Chapter.

Buy Victory Bonds



Rochester Chapter Chairman Earle DeBisschop welcomes Dr. Ernest J. Abbott of Physicists Research Company, technical speaker at September 12 meeting. While Rochester Chapter assembles to hear Dr. Ernest Abbott of Physicists Research Company discuss "Measurement of Surface Finish," he hangs charts showing increase in the use of measuring instruments to improve surface finish. Education Chairman Sherman Hagberg steadies ladder.

Rochester Chapter Executives Hold Annual Clambake

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Gathered at the Conesus Lake summer home of Past Chairman Cecil E. Lucas, September 8, 30 present and former executives of Rochester Chapter enjoyed a clambake prepared by "Jake" Phillippsen and his staff of clam washers.
1. Mouths watering with anticipation, Emmett Moore, Charles Codd, Joseph Schick and Russell Howard (left to right) watch "Jake" Phillippsen (center) frying chickens to a delectable golden brown. 2. Benny Goodman (not the band leader) follows Cecil Lucas' Chriscraft, via surf board. 3. Jerry Sick (background) studies Benny Goodman's surf boarding regalia. 4. Expressing deep satisfaction Don Kohler (holding cup), Fred Bittner, Chauncey Newton, Clifford M. Sears, Joseph Schick, Bob Moore (left to right) and Don Dony (at end of table) polish off bountiful picnic spread. 5. Just waiting for the mess call. 6. Dog "Tippy," Charles DeMartin, Jake Phillippsen and Earle DeBisschop (with swordfishing hat) relax in the late afternoon sunshine. 7. Herbert Simon (second from left) tells about "the big one that got away." Jimmy Horne, Earle De Bisschop, Bernard Williams, Bob Moore, Charles DeMartin and Jake Phillippsen (left to right) register varying degrees of credence.

ASTE-Town Tours—Fond du Lac, Chapter of the Year

Strategically grouped about Lake Winnebago and its connecting waterways, the dozen or more cities from which are drawn the members of Fond du Lac Chapter, ASTE, have developed into the second largest industrial area in Wisconsin. Included in this northeastern section are such recognized manufacturing centers as Oshkosh, Sheboygan, Green Bay, Manitowoc, Neenah, Appleton, Kaukauna, Brillion, Clintonville, Ripon, Oakfield, West Bend, New Holstein, Berlin and Fond du Lac.

Fond du Lac, named "head of the lake," by early French traders is uniquely situated at the southern end of the twenty-eight mile long lake which effectively obstructs access to the eastern part of the state, forcing all transportation to converge at this point. Thus geographically favored, the city has become one of the most important commercial, industrial, agricultural and transportation centers in the state. Four through highways and the main lines of three railroads enter the community, making it the hub of a large distribution area. For 21 years it has had an airport with hard runways and concrete block hangars.

One of the earliest industries to locate in Fond du Lac, the 86-year old Giddings & Lewis Machine Tool Company is the world's largest exclusive manufacturer of horizontal boring-drilling and milling machines. Other large plants include the Tobin Tool and Die Company, Inc., for many years major contributors to the design and production of precision tools; Wells Manufacturing Corp., the country's largest producer of magneto and ignition replacement parts; Sanitary Refrigerator Company, pioneers in the manufacture of quick-freeze, mechanical ice boxes; Damrow Bros. Co., largest of the four plants in the U.S. specializing in cheese and milk factory equipment and machinery; and The Michler Company, manufacturing blacksmiths who build the world's largest commercial sleighs.

Now in its 91st year the Fred Rueping Leather Company, Fond du Lac's oldest industry, is one of the nation's largest tanners of fine shoe leathers for uppers. Among newcomers is the zinc dry battery can division of the Ray-O-Vac Company.

Highly diversified is the list of products, exceeding $55,000,000 in value, turned out annually by the 5400 men and women employed in the city's 70 plants.

Instrumental in the development of many industries in the chain of towns encircling Lake Winnebago, tool engineers have helped build four-wheel drive trucks and multiwheel vehicles at Clintonville; paper mill equipment at Appleton and Neenah which also manufactures paper products of all types except cellophane; multiwheel vehicles, trucks, transmissions, front, rear and tractor axles; control transfer cases, logging tool equipment, snow plows and municipal garbage disposal and handling equipment at Oshkosh; washing machines and allied equipment at Ripon; brick and brick manufacturing machinery at Oakfield.

West Bend has become known for leather products, brake bands and stamping equipment; Sheboygan for containers and tool equipment; New Holstein, small gasoline engines; Manitowoc, ship building and aluminum ware; Brillion, castings and agricultural machinery; Kaukauna, heavy machine equipment; Green Bay, paper making machinery and power shovels; and Berlin, food canning and milk processing equipment.

In October of 1941, inspired by such an industrial galaxy, William E. Rutz, Vice President and Works Manager of Giddings & Lewis Machine Tool Company, invited a group of engineers and manufacturing executives to Hotel Retlaw, Fond du Lac, to discuss the organization of an ASTE Chapter. With the war machine already gathering momentum, the need for such an organization was apparent and the idea was accepted with alacrity.

Within a few weeks membership was developed to charter strength. On November 28 Otto W. Winter, then First Vice President of the Society, presented Fond du Lac Charter, No. 45 to Mr. Rutz who thereupon acquired the appellation, "Old Man of Chapter 45."

Officers elected by the new group were: Chairman, K. F. Gallimore, Vice President and Chief Engineer, Giddings & Lewis Machine Tool Company; First Vice Chairman, A. F. Schroeder, Tool Supervisor, Wisconsin Axle Division, Timken-Detroit Axle Company, Oshkosh; Secretary, Henry S. Faith, Production Engineer, Giddings & Lewis; and Treasurer, A. E. Mietzel, Works Manager, Tobin Tool and Die Company.

Under the leadership of these executives and Membership Chairman Charles Billberg, General Superintendent, Wisconsin Axle Division, the new Chapter, during its first year of existence, tied with Louisville for the ASTE Membership Trophy awarded annually to the Chapter having 100% paid-up dues and the highest percentage of membership increase.

Chapter meetings held alternately in the various cities surrounding Lake Winnebago spread enthusiasm and membership to others within the Fox River Valley. Valuable information divulged at each technical session was passed along to fellow workers and, despite gasoline rationing, meeting attendance continued to increase.

Last year, during the administration of Chairman William Felten, Master Mechanic, The Vollrath Company, Sheboygan; and Membership Chairman Cletus A. Wetli, Planning Engineer, Hudson Sharp Machine Company, Green Bay, Fond du Lac Chapter again had the distinction of winning the National Membership Cup, an award made possible only through the co-operation of every member of the Chapter.

Now less than four years old, Chapter 45 has built its membership to 155. With eight serving in the Armed Forces, the 147 members supporting the production front have given outstanding service in the advancement of the war effort, including participation in some of the atomic bomb developments. War materiel produced in this area has reached every fighting front and every branch of the service.

Officers of Fond du Lac Chapter, two-time winner of the ASTE National Membership Trophy, rejoice in possession of the coveted cup. Left to right are: 1944 Membership Chairman Cletus A. Wetli, Planning Engineer, Hudson Sharp Machine Company, Green Bay, and 1944 Chapter Chairman William Felten, Master Mechanic, The Vollrath Company, Sheboygan, during whose administration the award was made. Chairman Gideon Kane, Production Engineer, Northwest Engineering Company, Green Bay; a spectator—Milwaukee Chapter Chairman A. R. Gieringer, Owner, Gieringer Tool & Mfg. Company, Milwaukee; Fond du Lac First Vice Chairman George E. West, Production Engineer, Kaukauna Machine Corporation, Kaukauna; Treasurer Jule P. Schommer, Tool Purchasing and Supervision, Wisconsin Axle Division, Oshkosh; and Secretary E. J. Kaiser, Chief Draftsman, Giddings & Lewis Machine Company. Presentation of the award was made by Regional Director L. J. Radermacher.

Lighthouse Harbor, Fond du Lac, Wisconsin, is one of the finest and largest on Lake Winnebago. Shown in the background is part of Lakeside Park, municipally-owned recreational area providing diversion, rest and a wide range of sports facilities.

Reconversion presents few problems in Fond du Lac. War workers displaced after V-J Day have been absorbed by civilian goods plants whose wartime personnel has been below normal levels.

Facilities for the manufacture of peacetime products have been little disturbed by their adaptation to the needs of war. Expansion of local companies, the addition of four new factories during the past two years and the prospect of two, sizable, new metal working plants assure abundant employment. Job opportunities are spread uniformly among industry, retail and wholesale operations, railroads, agriculture and recreation, no one economic condition dominating the prosperity of the city's 30,000 population.

Civic betterment has not been overlooked during the commercial growth of the 110-year old community, founded in 1835 at the close of the Indian occupation of the former fur-trading post. Its fine schools, churches, amusement and sports facilities, 225 acres of parks, cultural and service organizations, and high percentage of home ownership, together with a friendly and hospitable atmosphere, make Fond du Lac a delightful place in which to live and work.

Lighthouse Harbor at Lakeside Park, maintained by the city, is one of the finest on Lake Winnebago. The many power boats quartered here navigate the Great Lakes, through the locks down the Fox River, to Green Bay and thence into Lake Michigan.

Lakeside Park is one of the most beautiful sites in eastern Wisconsin, with lagoons, horticultural gardens, a zoo, baseball and soft ball diamonds, lovely shade trees, fireplaces and picnic grounds. Bath houses, a recreation building, and dance hall are also open to the public. The Girl Scout Wild Flower Sanctuary, the only one of its kind in the U.S., and the elaborately-equipped children's playground are park features offering juvenile amusement.

Recreational opportunities are not limited to Lake Winnebago with its fishing, swimming and boating advantages in the summer, and skating, ice boating and ice fishing in the winter. Those who know the region are familiar with the scores of smaller lakes and trout streams lying within easy driving distance of the city.

* * *

Fittingly, this progressive locality is the home of the ASTE "Chapter of the Year"—one which has dedicated itself not only to advancing the Society's purposes, but also to promoting the professional standing and interests of production executives throughout the Chapter area.

Abrasive Wheels Grind To .0002 Tolerance

Fond du Lac, Wis. — Wheels capable of grinding materials ranging from carbide tipped cutters to whale blubber are now being provided by the abrasive industry, Francis D Bowman, Director of Public Relations, Carborundum Company, Niagara Falls, New York, told Fond du Lac Chapter, meeting September 14 at the Beaumont Hotel in Green Bay.

In his address, "Higher Production and Greater Precision Through Grinding," Mr. Bowman reviewed the origin of the 54-year old grinding industry, when Edison laboratory workers poured a mixture into a simple iron pot and, by means of a carbon rod connected by open wires to a power source, made the first carborundum crystals.

Thousands of parts used in airplanes, automobiles and guns have been ground to size and held to tolerance of .0002 by the various types and grades of grinding wheels available, the speaker pointed out.

Regional Director L. J. Radermacher of Milwaukee presented the ASTE Membership Trophy won in 1944, for the second time, by Fond du Lac Chapter. The cup is awarded annually to the Chapter having the highest percentage of membership increase and 100% paid-up dues.

Approximately 100 members from the various cities in the Fond du Lac area attended the meeting.

"An Exact Duplicate"

Toledo, Ohio—The fall program of the Toledo Chapter got under way September 12 with a dinner and technical session at the Toledo Yacht Club, attended by 138 members and guests.

The technical portion of the meeting was capably handled by William Lipp, Sales Engineer for the George Gorton Machine Company, Racine, Wisconsin. "An Exact Duplicate," a color-sound film depicting the wide variety of duplicating machine applications, preceded a question-answer discussion led by Mr. Lipp.

A second film, "B-29's Over Dixie," showing the difficulties overcome in introducing highly technical manufacturing to a section of the country not normally engaged in heavy industry, provided an interesting conclusion to the evening's program.

Part of the live-wire group from the cities comprising Fond du Lac Chapter, shown at the September 14 meeting in the Beaumont Hotel, Green Bay. Nearly 100 members were present for the opening meeting of the season.

BUILDERS OF ASTE — *T. B. Carpenter, President 1934-35*

By O. B. JONES, *Society Historian*

Friendliness is one of those intangible riches which some men inherit and which time and moths can't corrupt. If ASTE can retain the friendliness of its third president, Bert Carpenter, it will continue to be immensely worth-while. The first time Bert shook my hand, many years ago, I knew he liked me. There's nothing unusual about that, as far as Bert is concerned. He likes everybody and believes in everybody. Big men are merely big boys. Bert is a boy everyone likes.

O. B. Jones

Something of the great simplicity, humor and enthusiasm of the man is reflected in his story of the third year's Society activities which follows:

"Mingled feelings of pride and apprehension were mine at the Directors meeting in March, 1934, when I was honored by election to the Presidency of ASTE. The following year's events justified these feelings. When my coworkers in Pontiac, at General Motors Truck, heard of my election, they promptly took up a collection and got me a beautifully polished "8" ball behind which I sat throughout the year.

"The first wave of enthusiasm that had brought our Society into being had pretty well died down. The depression was at its depth. Our membership was seriously invaded by a rival society claiming more immediate and monetary gains for its members than we could obtain by our policy of social, technical and educational activities.

"Actually, I remember thinking at this Board of Directors meeting—while voting for one of the unsuccessful candidates—'if the poor guy holds this thing together for another year, he will be plenty lucky.' Well, the poor guy who got the job was lucky. Lucky in that he had an excellent group of officers to serve with him, as well as some experienced advisers led by Past Presidents Joe Siegel and Bill Smila who gave unstintingly of their time and good advice which was desperately needed and deeply appreciated.

"That third year of our Society's existence will go down in my book as 'The Stormy Year.' The records show 27 regularly-conducted membership, board, and executive meetings, most of which lasted far and loud into the night. These were in addition to committee meetings, extra group conferences, rump sessions, and so forth.

"Probably the greatest peril for the Society was in connection with the regular resignation of prominent members, formally tendered at nearly all important directors meetings. This peril was overcome when these good members withdrew their resignations and continued to pitch as usual.

"Other officers for the year included: First Vice-President, R. M. Lippard; Second Vice-President, Ford Lamb; Secretary, A. M. Sargent; and Treasurer, Joseph Slavik. Serving as committee chairmen were: Standards, William Smila; Publications, O. B. Jones; Industrial Relations, Frank Gertiser; Constitution and By-Laws, Walter Wagner; Meetings and Entertainment, Joseph Siegel; and Membership, Walter Kasturski.

"All performed their duties with honor and distinction, and not enough credit can be given to them for what success was attained during the year. Various members served on other committees from time to time, but those named were most active.

"Giving honorable mention is quite difficult as I had a great deal of help in those days. You will remember there wasn't must else to do just then. The following group of men, as far as my memory serves, contributed much to the welfare of the Society during that year: Swan Bergstrom, Roy Bramson, Lee Diamond, William Fors, David Forsman, James Giern, William Gray, William Hart, William Maier, and Andy Rylander. No officers or committee chairmen are included in this group as the recognition they deserve goes beyond honorable mention.

"We had excellent programs during the year, many of which were featured by speakers from well-known organizations, and others by those who received their training in our own Speakers' Club. The most interesting and entertaining event was the train trip to Cincinnati Milling Machine Company. The most outstanding and best-attended meeting was the one at which Ralph Flanders of Jones and Lamson was our speaker.

T. B. Carpenter

"Along about the middle of the year, *The ASTE Journal* began to make its influence more strongly felt, and we received many letters from readers, some of which were published in the journal. Various engineering organizations, both local and international contacted us concerning co-operative programs and activities. The one that gave us the greatest pleasure and prestige was the invitation received from National Machine Tool Builders Association to sponsor a meeting at the Machine Tool Congress to be held at Cleveland in September of 1935.

"All in all, the quality of our meetings compared favorably—if not in attendance—with those of previous years. Problems of Chapter management and membership received very little consideration during this year, as our policy was to maintain and strengthen from within rather than to expand. We also adopted a policy of trying to keep the membership informed of everything that was going on whether good or bad.

"In accepting the responsibility of the President's office, I was motivated by the ideals of most of the other organizers of the Society—namely that there was a definite place in our industrial educational setup for such a society, and I was willing to put my best efforts into making it a success. The benefits received were manifold, some of which were wider acquaintance with fellow workers in the same field, interchange of practical ideas and that intangible thing you might call 'Awareness of Civic Responsibility.'

"Recognized and shouldered, after all, the difference between barbarism and civilization is the ability to make two blades of grass grow where only one grew before, to provide means—by the use of labor-saving methods and mechanisms—of alleviating hardship and poverty; to raise the standards of living by making more good things available to more people.

"The fact that, for four years, the talent of our organization has been directed toward manufacturing tools of destruction should not deter us from the original purpose. Let us rather be thankful that we possessed skill and the means to cope with this problem and get it over with as quickly as possible, so that we might again take up our normal peacetime pursuit.

"Looking into the future, it seems that the professional standing of the Society could be elevated materially through closer co-operation with manufacturers not only of tools and machinery but of the various components on which this equipment is used. A further recognition of professional standing could be attained by interchange of educational programs with engineering schools. Chartering of Student Chapters in engineering colleges has already borne fruit, and it seems that this should be another contributing factor toward lifting the professional standing of our Society membership.

"When my year of service was brought to a close, I had mixed feelings of relief and accomplishment. While the Society was not much improved from the standpoint of finance and membership, we did accomplish most of the things we had set out to do. Principally, these projects were to strengthen our internal organization, raise the standard of membership requirements, develop speakers and leaders within our own membership, and split up the executive responsibility while letting our committee chairmen and other officers conduct meetings and assume as much responsibility as they would.

"Along with our work, organizational problems, and technical program, we still managed to have a pretty good time that year at our social functions. Two successful dinner-dancing parties were held. The highlight of family activities was reached at the annual picnic in July, featuring the usual races and events for the kids, and a soft-ball game between the single and the married men.

"At the end of the year, the future seemed to hold nothing but the best prospects for the Society. Our method of data sheet preparation and distribution was well under way. A second Chapter was in the process of organization. The publication set-up was working satisfactorily and has continued to do so. We made mistakes along the way, but we tried to acknowledge them, pointing out the pitfalls encountered to those who were to follow us.

"In spite of these mistakes, I feel that whatever small measure of personal success has come my way has been due in a large degree to the responsibility entrusted to me by the Society, an opportunity for which I shall always be grateful."

Obituaries

Glennon J. Mueller

Stricken by a heart attack, Glennon J. Mueller, 21, Assistant Chief Tool Designer, National Slug Rejectors, St. Louis, Missouri, recently passed away at his home in that city where he was affiliated with the local Chapter of ASTE.

G. J. Mueller

A native and lifelong resident of St. Louis, Mr. Mueller received his technical education at St. Louis University and Harris Junior College, subsequently becoming associated with Maloney Electric Company, Curtiss-Wright Corporation, and White Rodgers Electric Company.

In his most recent connection with National Slug Rejectors, his work was considered outstanding. Commenting on the young man's untimely demise, M. K. Patten, Chief Tool Designer for the company, said:

"I feel that Glenn was very directly responsible for this company's receiving the Army-Navy 'E' award. The tooling of this program required long hours and hard work. . . . It was hard to realize that he was so young in view of the way he conducted himself and the accuracy that he used in the pursuance of his work. He was very patriotic as indicated by his activities in the C.A.P. where he gained a commission of 1st Lieutenant. Through hard work and his C.A.P. activities, he tried to compensate for his keen disappointment that his physical condition prevented his joining close friends in the service. We who were closest to him feel that he overdid, apparently injuring his health to a great extent.

"I consider Mr. Mueller outstanding among young men who have worked with me in the past, in view of his brilliant mind, his natural adaptability to this occupation and, above all, his integrity as a man of highest quality in every respect. His workmanship as a draftsman was exceptional.

"His death was caused by heart failure shortly after he had had dinner at the end of what we considered more or less a normal day. The C.A.P. tendered him a military funeral attended by the entire engineering staff of National Slug Rejectors."

* * *

Frank Phillips

Frank Phillips, 55, Assistant General Foreman of Machine Shop, General Railway Signal Company of Rochester (New York), died recently after being stricken with a heart attack.

Though born at Toronto, Canada, Mr. Phillips became a citizen of the United States in 1915, residing at Rochester until the time of his death.

He had been employed by the General Railway Signal Company at Rochester since 1918 in various capacities, and was affiliated with the ASTE Chapter in that city.

* * *

Harvey A. Gifford

Harvey A. Gifford, 37, Methods Engineer at Scintilla Magneto Company, Sidney, New York, succumbed August 18 to a lingering illness of five months. On May 26 he underwent a serious operation at New York Cornell Hospital, New York, which failed to relieve his suffering, and his condition gradually grew worse until his death.

A native of Sidney, he had been employed at Scintilla in various capacities since 1928. He attended Sidney High School, was a graduate of Lowell Business School, Binghamton, and a member of Binghamton Chapter, ASTE.

Situations Wanted

VETERAN, 18 months Ordnance, formerly Metallurgist, Tool and Production Man, Sales Engineer with major Cold Finished Steel Producer, 36 years old, member ASTE and ASM, interested in Metallurgical or Sales Engineering work, either domestic or foreign. In reply, please mention salary and territory. Write Box M—American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

CAN FILL POSITION as Shop Manager, Production or Sales Manager—Twelve years shop experience in machine shop management, layout, inspection and tooling machine shop department; set up production lines, trouble shooting, cost and machine load estimating, and routing; broad experience in handling large and small groups of people and in dealing with the public. Write Box N—American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Michigan.

Lundwall Vice President Asa S. Cook Company

Providence, R.I.—Recent changes in the administrative personnel of the Asa S. Cook Company include the election of A. Edwin Lundwall as Vice President in Charge of Production. Mr. Lundwall, who holds the same office in Standard Machinery Company, will continue in both positions.

The Cook Company has moved its equipment from New Haven to the enlarged plant of the Standard Machinery Company in Providence, to facilitate increased production of its regular line of machinery and service parts during the postwar period.

A member of Hartford Chapter, ASTE, Mr. Lundwall was formerly connected with the D. E. Whiton Machinery Company and the J. N. Lapointe Company of New London, Connecticut.

"Social Engineering" Lags In Mechanical Age

Louisville, Ky.—Honorable Eldon S. Dummit, Attorney General of Kentucky, Frankfort, was guest speaker at Louisville Chapter's "Family Night" held September 10 at the Kentucky Hotel.

Using the topic, "Social Engineering," Mr. Dummit presented in a highly entertaining manner many constructive ideas for the advancement of the post-war social structure of this country and the entire world. He observed that progress in human engineering had not kept pace with the rapid strides made in mechanical engineering.

Film Flashes

* *Magnesium*—Packed with vital information concerning this miracle metal, the film reveals the extraction of magnesium from sea water and brine pumped from underground salt beds; chemical treatment and the transforming of milk of magnesia into magnesium chloride, and eventually to pure magnesium; and the proper pouring and fluxing of magnesium alloys to secure maximum physical properties.

All classes of machining operations are pictured, demonstrating how magnesium alloys machine from 25% to 50% faster than other metals.

The film shows the remarkable advantages of magnesium alloys to be effected in the manufacture of civilian goods, through light weight, great strength, easier and faster machining and a reduction in processing and handling costs.

The producers can stage an entire program for technical organizations, including a short talk outlining the past, present and future of magnesium and an exhibit of sheets, rods, tubing, extrusions, forgings, die, sand and permanent mold castings.

Information concerning this presentation may be secured from Hills-McCanna Company, 3025 N. Western Avenue, Chicago 18, Illinois.

* * *

* *The Peace Builders*—This dramatic, documentary screen story of the historic co-operation that won the war and will attempt to build the peace includes sequences taken at The Atlantic Charter Meeting, Casablanca, Ottawa, Moscow, Cairo, Teheran, Bretton Woods, Hot Springs, Dumbarton Oaks, and the Crimea Conference at Yalta.

It reflects the confidence and power of the democratic peoples of the world to solve their problems through co-operation. Shall we accept and work for this chance for peace? Or shall we let it go and risk more wars? The American people are thinking about it . . . talking about it . . . and acting on it.

Produced by the National Film Board of Canada, the 10-minute, sound film is released through Brandon Films, Inc., 1600 Broadway, New York 19, New York, from whom prints may be rented.

* * *

* *A Recital of Faith*—A graphic story of the only assembly of plants in the world where raw bauxite goes in at one end and aluminum shapes come out at the other is unfolded in this film. It is the story of a man, who, according to the former Senator Truman, "risked his private business and mortgaged it to make aluminum for the benefit of the country as a whole when the country desperately needed it."

All of the important operations in the square mile of plants, built in 1940 when Germany's production of aluminum exceeded ours, are shown in the four-mile motion picture tour.

Peacetime uses of aluminum in new fields such as transportation, construction, housing, furniture, and foil for protective wrapping and decorative labels are also pointed out.

Available from Reynolds Metals Company, Inc., Aluminum Division, 2500 South Third, Louisville 1, Kentucky.

* * *

* *Tornado In A Box*—Designed to serve a dual purpose, the film explains

(*Continued on next page*)

Film Flashes

(Continued from preceding page)

the basic theory of the construction and operation of the gas turbine to the layman, and the technical facts to engineering experts.

The scene opens with a business man, surrounded by gas turbine publicity, shouting over the phone that he wants to know what it's all about.

Through trick photography, a note of humor is interjected in the phantom-like appearance and disappearance of a motion picture narrator who explains, as the theme progresses, the history, theory and technical phase of the subject. Animated drawings, graphs and temperature charts tell the engineering story.

When the narrator and the engineer "get technical," the bewildered businessman is unable to follow them and his remarks lend an amusing touch.

The production ends with the businessman predicting the possible future role of the gas turbine.

The 30-minute, sound film may be borrowed from Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin.

* * *

* *Hack Saws And How To Use Them* —Meeting an urgent need for specific information on the proper choice and correct use of hand and power hack saw blades this educational film is of interest to both new and experienced operators.

It shows in slow motion how hack saws cut and how the teeth produce different types of chips on a variety of materials.

Emphasis is placed on the care necessary to secure maximum production and blade life, the importance of modern production cutting with hack saw blades, and the new technique of hack saw tensioning which has helped many plants to attain greater cutting efficiency.

Simonds Saw and Steel Company, Fitchburg, Massachusetts, will lend the 16 mm. color-sound film upon request.

* * *

* A selection of literature describing these and many other films, and an extensive list of technical motion picture productions is available to ASTE Chapter Program Chairman. This material contains valuable information for planning good technical programs. Some of the films listed are comprehensive enough to constitute a technical session when a speaker is not available. Write to American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

Toronto Schedules Timely Topics

Toronto, Ont.—With its program well lined up, Toronto Chapter looks forward to another successful season.

On November 12 the Chapter will meet to hear R. A. Schaefer, Development Engineer, National Automatic Tool Company, Inc., whose subject will be "Multiple Spindle Drilling Operations and Tooling Technique."

The Annual Executives Night comes on December 10 with Neil Peterson, President, Canadian Acme Screw and Gear, Ltd. and York Arsenals, as guest speaker.

A representative of Thompson Grinder Company will give an address on "Crush Form Grinding," illustrated with motion pictures, January 14.

Werner Senger, Gisholt Machine Company is slated for February 11 when he will explain "Balancing Machines" and present the technicolor sound film, "Set Up and Tooling Turret Lathes."

Plans are being completed by the Entertainment Committee, headed by L. M. Jardine, for the annual Ladies Night, scheduled for March 15 in Concert Hall, Royal York Hotel. Dance music will be furnished by Stanley St. John and his orchestra. This is expected to be the biggest event in the history of the Chapter.

Regular dinner meetings are held in Malloney's Art Gallery at 6:30 P.M.

Hoyer Appointed Chief Engineer

Dayton, Ohio — Albert C. Hoyer, formerly of the City Engineering Company, has been appointed Chief Engineer for Faultless Machine & Tool Products, Inc. In addition to directing all engineering activities, he will handle contract design work for his company which is equipped to offer customers a complete service in product designing, processing, tooling and manufacture.

A. C. Hoyer

For the past 17 years, Mr. Hoyer, who is affiliated with Dayton Chapter, ASTE, has been engaged in engineering design and tool work for a number of companies in the Dayton area.

Former Combat Pilot Joins Chrysler

Indianapolis, Ind.—After four years of distinguished service in the U.S. Air Force, recognized by numerous awards, Maurice R. McLary has returned to industry as Tool Engineer for Chrysler Corporation, Airtemp Division.

M. R. McLary

Entering the service in August of 1941 as an Aviation Cadet, he trained at Oklahoma City and was sent overseas two years later. For ten months he flew P-38's (Lockheed Lightnings) followed by six months piloting of P-51's (North American Mustangs), totalling 318 combat hours during 83 missions.

Advancing to the rank of Major, he became Commanding Officer of the 77th Fighter Squadron, engaged in escorting bombers, dive bombing and strafing. During his aerial activities, he destroyed or probably destroyed eleven German planes, numerous locomotives, trains, barges, tanks and gun emplacements, and participated in the first seven raids over Berlin, the Normandy invasion and aerial offensive of Germany, France, Holland and Belgium.

On several occasions his plane was badly shot up, and he survived two crash landings in England.

Decorations and citations in honor of his achievements include a Distinguished Flying Cross with one Oak Leaf Cluster, an Air Medal with seven Oak Leaf Clusters, two Theatre of War ribbons, three battle stars and Presidential Citation.

Prior to enlisting, he was affiliated with Cincinnati Chapter, ASTE. He is now a member of Indianapolis Chapter.

Negative Rake Milling Research Shown

Kansas City, Mo.—R. O. Dorow and Merlin R. Grundy of Kearney and Trecker Corporation, Milwaukee, appeared recently before Kansas City Chapter, presenting the sound film, "Carbide Negative Rake Milling," featuring research done in negative rake angles for milling.

Following the firm, Messrs. Dorow and Grundy conducted a discussion period, answering many questions from the floor.

Windsor Chapter 1945-46 Officers

Left to right: First Vice Chairman W. Bruce Moore, Tool and Equipment Engineer for Chassis Division, Chrysler Corporation, Windsor; Treasurer A. E. Carley, Tool Engineer, Chrysler Corporation; Chairman C. G. Sampson, Superintendent Machine Shop, Ford Motor Company of Canada, Ltd., Windsor; Secretary P. O. Harrison, Manager, Windsor Office Canadian Fairbanks-Morse Company, Ltd.; Second Vice Chairman R. T. Richards, Divisional Superintendent, Machine Shop, Ford Motor Company; and Immediate Past Chairman David Barnett, Master Mechanic, Walkerville Plant, General Motors of Canada, Ltd.

Conversion Tooling Time Cut By "Photo-Lofting"

Baltimore, Md.—"In certain respects, the job of tooling for peace is even harder than tooling for war proved to be. . . . The tool engineers of America have unquestionably earned a rest—many of us are suffering now from what has been termed 'non-combat fatigue'—but the time has not yet come to relax. Until the factories, yards and plants, so recently geared for war, have retooled for peace, the war will not be fully over nor the rewards of victory assured. We tool engineers have one more big job to finish before business can operate freely on normal lines or adequate employment, and purchasing power be assured for millions of returning veterans."

N. H. Lou

This challenge to Tool Engineers highlighted the address, "Tooling For Peace," which Nils H. Lou, Assistant to the Vice President in Charge of Manufacturing, Glenn L. Martin Company, Baltimore, delivered before the September 5 meeting of Baltimore Chapter, ASTE.

In his opening remarks, Mr. Lou, formerly Baltimore Chapter Chairman and National Director of the Society, said: Throughout the last four years, I cannot recall that anyone ever had cause to be concerned about the morale of America's tool engineers. The tool engineers saw their responsibility clearly and they shouldered it without question. Even though there were times when it seemed impossible to accomplish all that was needed—with the shortages of materials and skilled help and especially with the limited time at their disposal—they met their commitments in full, translating the blueprints of army, navy and civilian planners into the tools of wartime production."

Continuing, he pointed out, "Members of both the German and Japanese General Staffs have publicly confessed that the quantity, quality and variety of U.S. war materiel, particularly in the air, exceeded anything they ever anticipated. This country's ability to tool as rapidly and effectively as the situation demanded was an immeasurably important factor in its all-out industrial mobilization for war and in the final victory. It may be an equally decisive factor now that peace is here. . . .

"Following the Pearl Harbor disaster, the entire country backed us in a wave of patriotic fervor. Though materials were short, money was no object—time was everything. Normally competing firms freely shared patents and trade secrets with one another, but today all that is ending, as industry reverts to its peacetime stride and peacetime methods of cost-accounting.

"Moreover, today people everywhere are a little tired. They feel that they have done their share. They expect the fine fruits of peace to drop into their laps without exertion—as if new refrigerators, washing machines, radios, automobiles, airplanes or Nylon hose could make themselves. What they do not quite grasp is that much effort, initiative and even sacrifice are still required to insure the American way of life. . . .

"According to press dispatches, the newspapers in Russia are following the employment situation in the United States with keen interest, even featuring it as front-page news. Possibly some people who do not know the United States doubt this country's ability to reconvert such a vast industrial network to peacetime production in an orderly manner; just as others were formerly sceptical of its power to deliver sufficient weapons of war in time. We disappointed the sceptics once and we will do so again—in part, by making use of the new, wartime inventions, techniques and production short-cuts.

Mr. Lou then proceeded to outline one of the methods used in overcoming war production tooling problems in the aircraft industry—the "photo-lofting" of lay-outs.

By the use of gigantic built-in photographic equipment, full scale layouts prepared on white-painted sheet metal are reproduced, eliminating the duplication of shop lay-outs. Reproductions may also be made directly on the construction material as in the case of model building—either full-scale or to any given reduction. This process, which has already been applied to several other industries, cut the tooling time for a medium-sized airplane as much as 100,000 hours, according to Mr. Lou.

A technical article detailing the process will appear in *The Tool Engineer*.

Another ASTE'er, Hugo Czerwonky of Potomac Chapter showed the film, "An Exact Duplicate," sponsored by the George Gorton Machine Company of Racine, Wisconsin, which he represents in this area. New and lesser-known techniques in "tracer-controlled" milling, duplicating and engraving were revealed in the technicolor, sound production. Mr. Czerwonky also spoke briefly prior to the screening of the film.

The opening meeting of the '45-46 season, held at the Engineers Club, was heavily attended.

Reveals Wartime Gaging Secrets

Muncie, Ind.—Revelations of processes and techniques which have heretofore been war secrets were made by Lou Lingler, Sheffield Corporation, Dayton, Ohio, technical speaker September 12 at the Muncie Chapter meeting held in Hotel Roberts.

While detailing the newest developments in gaging tools and instruments and their use in the shop and laboratory, Mr. Lingler demonstrated how precision control of the product, at the machine, could cut time, scrap and costs, and add years of service-free use to the product being manufactured.

Knowledge and experience gained in working to the close tolerances of Army and Navy specifications can be carried, with slight modification, directly to peacetime production, especially in the manufacture of automobiles, refrigerators, washing machines and similar power-operated equipment, in Mr. Lingler's opinion.

Crush dressing and its application to various grinding jobs was also discussed by the speaker.

At the conclusion of his talk, Mr. Lingler invited the audience to inspect and operate the more than two dozen gages and measuring devices which he had set up for the demonstration. Measuring millionths of an inch on an instrument sensitive enough to determine the thickness of a fingerprint on a polished steel bar engrossed the ASTE'ers long after the meeting had been adjourned.

All men of science desire to have their contributions to knowledge used to the utmost for the benefit of mankind. Like good coin, the more it is turned over the greater their reward.

Sir Wilfred T. Grenfell

Muncie Chapter Sees Gage Exhibit

Upper Left: Mr. Lee, Lou Lingler, Sheffield Corporation, Dayton; Jack Rovick and Charles Marker (back to camera) chat following gaging lecture delivered by Mr. Lingler at September 12 meeting of Muncie Chapter. Upper right: Louis Slentz, Carol Crabb, Messrs. Lee and Lingler. Lower Left: Mr. Lee, Ralph McLaughlin, Mr. Lingler and Burl Kirk. Lower Right: Ralph McLaughlin, James Rutter, Jr.; Burl Kirk and Robert R. Breeden.

Master Gage Exhibit Features Talk

Syracuse, N.Y.—The complete display of master gages exhibited and demonstrated by Francis Lyons, Sales Engineer, the Do-All Company, Minneapolis, was of intense interest to Syracuse Chapter members present at the September 11 meeting in the Onondaga Hotel.

After further illustrating with slides his talk on "Master Gages and Gage Blocks," Mr. Lyons conducted a question and answer period.

The meeting closed with the showing of informative, colored films concerning Argentina and Mexico.

ATTENTION, CHAPTER CHAIRMEN

Have your Chapter represented every month in ASTE News. Complete information concerning publication schedules and material desired appeared on Page 62 of the September issue. Please request the co-operation of your Chapter officer responsible for reporting news to *The Tool Engineer.*

Education Chairman Urges Professional Thinking

Hamilton, Ontario, — Approximately 125 members and guests of Hamilton Chapter turned out for the first meeting of the season, September 14, to hear National Education Chairman Otto W. Winter, Vice President of the Acme Pattern & Machine Company, Buffalo, deliver his address, "The Professional Aspects of Tool Engineering."

An able speaker, he conveyed his enthusiasm to the audience, urging his listeners to advertise their calling and endeavor to elevate its importance in the community. He also reported on the progress being made in the Society's program to promote a degree course in Tool Engineering.

Out-of-town guests included Assistant Secretary-Treasurer W. A. Dawson of Toronto who introduced the speaker; Past Chairman C. D. Wright, Chairman Henry Hendricks and several other members of Niagara District Chapter, and J. E. Greig of Buffalo Chapter.

Research Expansion Vital In Preserving Peace

Cincinnati, Ohio—A popular speaker among ASTE groups in the Ohio area, Major Raymond S. Fanning, Combat Intelligence Officer, Wright Field, Dayton, made a return appearance for Cincinnati Chapter's September 11 meeting at the Engineering Society Building.

Major Fanning's official activities in presenting a comprehensive, day-by-day account of the war to the Commanding General Staff at Wright Field have made him an authoritative speaker on this subject.

In his address to the local Chapter, he reviewed the last eight months of the conflict, telling of the progress in research made by our former enemies as demonstrated in their equipment. He warned that a lasting peace could not be assured without expansion of research efforts in the United States.

A lively discussion period followed his talk.

Animated Discussion Follows Salvage Talk

New Orleans, La.—"ASTE'er Larry Lang deserves a pat on the back inasmuch as he traveled from Detroit to speak to our Chapter on 'Tool Salvage and the Care of Tools,'" was the appreciative comment of New Orleans Chapter Chairman Edwin E. Graf, reporting on the September 11 meeting at the Jung Hotel.

Larry Lang

Mr. Lang, Vice-President of National Tool Salvage Company, Detroit, used 30 slides to illustrate his remarks on tool control, tool repair, and carbide tipped tools.

Keen interest in the subject was reflected in the number and variety of questions asked during the subsequent discussion period. Some of the approximately 60 engineers who attended the meeting tried to contact the speaker the following day to ask more questions.

Machining Costs Reduced By Surface Broaching

Minneapolis, Minn. — Importance of surface broaching as a production tool was emphasized by George Squibb of the Broaching Division, Cincinnati Milling Machine Company, Cincinnati, Ohio, technical speaker September 12 at a meeting of Twin Cities Chapter.

George Squibb

While asserting that parts could be machined by surface broaching at approximately one-thirtieth the cost of milling, he made it clear that milling still holds preference in many machining operations. He recommended carbide-tipped broaches for machining cast iron, but indicated that high speed steel broaches were generally used for other materials, because of the slow travel of the ram.

Mr. Squibb, who serves in an advisory capacity in the production of U. S. Office of Education films on surface broaching, illustrated his talk with slides showing machine and broach designs.

Mechanization Makes Jobs

Cleveland, Ohio—Two widely known engineers, J. H. Quick and P. H. Taub of the Industrial Engineering Department, Camden (New Jersey) Plant, RCA, collaborated in Cleveland Chapter's September 14 technical session, "Tool Designing For Production."

Highlighting their discussion on the mechanization of post war industry was the statement that the introduction of mass production had increased employment 40% in the prewar automotive industry, exploding the fallacy that mechanization causes unemployment.

The speakers also outlined the application of the principles of motion economy in the design of tools and fixtures, and the influence of work simplification on dies, jigs and fixtures. Films illustrated before and after production outputs.

Excerpts from the Charlie Chaplin production, "Modern Times," a parody on the production line, entertained the group.

National Education Chairman Otto W. Winter receives an ovation from Hamilton Chapter as he is introduced by Assistant Secretary-Treasurer W. A. Dawson at September 14 meeting in Royal Connaught Hotel. Mr. Winter spoke on "Professional Aspects of Tool Engineering."

Left to right: Meetings Chairman John Walton, Mr. Winter, Chairman Harry Whitehall, Mr. Dawson, Editorial Chairman K. R. Laidley, Education Chairman R. T. Vincent, Secretary J. E. Ball, Chairman Henry Hendricks and Past Chairman C. D. Wright both of Niagara District Chapter.

Finlay Helps Introduce Mass Production In Australia

Lithgow, N.S.W., Australia — How American equipment for mass production, introduced in Australia prior to World War I, was directly responsible for the accelerated production of armafor World War II and the development of Commonwealth industry is now revealed in a letter received at ASTE National Headquarters from John Finlay, Divisional Manager, Ministry of Munitions, Small Arms Factory, Lithgow.

John Finlay

Mr. Finlay has been associated with the Ministry of Munitions since 1911 when he returned to his native country after two years spent in the United States as a representative of the Commonwealth Government. During this period he was assigned to the Pratt & Whitney plant at Hartford, Connecticut.

His subsequent activities are reviewed in the following communication:

"As to how things are progressing 'down under', I think that perhaps a little history of this factory may be of interest to you. It was originally equipped by Pratt & Whitney in 1911, and they supplied the complete plant of machine tools, fixtures, cutting tools, gauges, and methods of operation. This was the first, modern, completely-tooled mass production factory erected in this country, and its influence has been of a very far reaching nature.

"Naturally, when the plant was put into operation, it was visited by many engineers from the various States, and the influence of this completely tool engineered plant for the mass production of firearms has been an incentive to many other engineering establishments. Many executives in the engineering industry today owe their start to their apprenticeship in our toolroom.

"It is interesting to note that, although Pratt & Whitney tooled up for our Rifle Manufacture in 1911, today, we still use at least 60 per cent of their original layout. This, I think, is a great credit to the Tool Engineers then in their employ. Of course, during the spread of years, the factory has grown, and during this war its activities were extended to many neighboring towns. At one period we had two major factories, eight feeder factories and two tool annexes under the control of the parent factory at Lithgow, and the total employees reached over the 12,000 mark.

"Owing to the excellent original equipment of our toolroom, and having to be so dependent on our own resources as we were approximately 100 miles from any engineering center, we had the necessity to develop this side of our work. Today, we consider that we have the finest toolroom in the Southern Hemisphere, and comprising the pick of the American, English, German and Swiss Machine Tools.

"Coming now to our own Society, I do not think that we have many members in Australia, and the nearest approach to our Society is the Institution of Production Engineers which is affiliated with the parent body in England. At the moment, there is a Sydney and a Melbourne branch in operation, and lately the parent body has established an Australasian Section Council to control the destiny of this Institution in Australia and New Zealand. This Council has only been formed this year, and I am pleased to state that I was given the honor of being its first President. I am enclosing a syllabus showing the lectures that are taking place both at our Sydney and Melbourne branches.

"Owing to the visit of so many of your Army personnel to this country, I feel sure that in the postwar period, there will be a greater exchange of representatives between our respective countries. I hope that some day we may have the pleasure of seeing some ASTE members at our factory in Lithgow."

Besides his ordnance activities, Mr. Finlay has handled considerable commercial work, including the designing and making of tools for the mechanism of Western Electric sound film equipment, the manufacture of which he also directed.

A member of ASTE since 1932, Mr. Finlay, in addition to his presidency of the Australasian Section Council of The Institution of Production Engineers, is also affiliated with the Iron & Steel Institute of Great Britain.

What's Your Program For December?

Announcements of December Chapter meetings should be sent to *The Tool Engineer* before October 15 for insertion in the November issue. Tell us when and where your meeting will take place, your speaker's name, company and subject. Write, wire or call Doris B. Pratt, *Editor,* ASTE News, *The Tool Engineer,* 550 West Lafayette, Detroit 26, Michigan. Tel: RAndolph 4230.

Hydraulics Adaptable In New Applications

Elmira, N.Y.—"New Developments In Hydraulic Transmission of Power," presented by Rudolph E. Esch, Manager, Machinery Equipment Department, Vickers, Inc., Detroit, commanded high interest among the 78 members and guests present at the September 10 dinner meeting of Elmira Chapter.

Elmira Chapter Chairman George N. Morceau greets Rudolph E. Esch of Vickers, Inc., guest speaker at September 10 meeting.

After a brief introduction, reviewing the history of hydraulic development and applications, Mr. Esch continued his discussion, using slides. Of particular interest were the illustrations of flexible controls, variable volume pumps and motors, application for constant surface speed while milling spherical surfaces, and the dual control unit used on the B-17.

At the close of the technical session a sound film was screened, revealing the amazing plant and facilities erected in Georgia for mass production of B-29 fortresses.

BUY VICTORY BONDS

"Injection Molding" Attracts Many

Toronto, Ont.—"The Mechanics of Plastic Injection Molding" proved exceptionally interesting and instructive as presented by Edgar Barker, President, Modern Tool Works, speaker at Toronto Chapter's September 10 dinner meeting held in Malloney's Art Gallery.

Mr. Barker, a Past Chairman of the Chapter, addressed a capacity audience of 160 or more, using slides to depict the various types of injection molding machines.

Explaining in detail precision molds and dies, he employed a variety of illustrations to show proper and improper design, emphasizing the importance of correct gating and runners.

Head table at Elmira Chapter's September 10 meeting. Left to right: Secretary Floyd B. Allen; Second Vice Chairman Edward Stachel; First Vice Chairman Burr W. Jones; Guest Speaker, Rudolph E. Esch; Chairman George N. Morceau; Chairman of Education Committee, Varner T. MacRorie; Treasurer James F. Deegan. Shirtsleeves prevailed because of unseasonable heat and humidity.

Engineering College To Have New Building

Detroit, Mich.—New quarters for the administrative offices, lecture rooms, drafting and engineering rooms of the Detroit College of Applied Science will be provided in the first unit of a modern building now under construction. Other units housing the physical, chemical and metallurgical laboratories and machine shop are expected to be ready for occupancy within a year.

Since 1926 when it was founded by O. B. Jones, then Assistant Chief Tool Engineer for Studebaker Corporation, Detroit, the school has been instructing engineering students in an ever-widening curriculum which now includes mathematics through integral calculus, physics, mechanics, strength of materials, drafting, tool design, die design, machine design, processing, time and motion study, plant layout and cost analysis.

Twenty-four months are required in day school for completion of the tool engineering course; the equivalent for evening students is 1560 hours of classroom work.

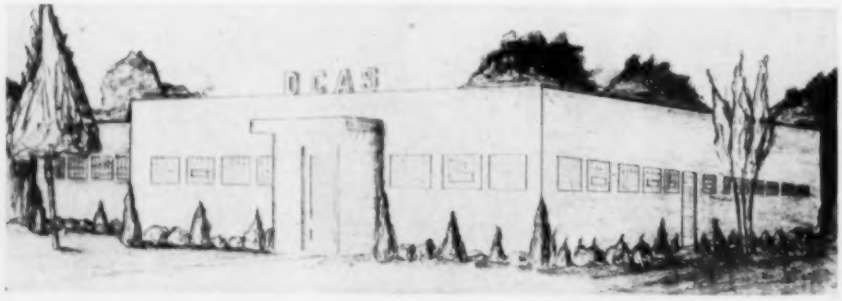
In 1930 the school was empowered to grant degrees in engineering. This was before the passage of the present state legislation prohibiting the granting of degrees by all but well-endowed institutions conforming to the rulings of the association of colleges.

Two years later, sensing the need of his students and of tool engineers generally for association with their confreres, Mr. Jones became one of a small group interested in organizing an engineering society. Within a few weeks, their joint efforts had culminated in the chartering of the American Society of Tool Engineers, with Mr. Jones as one of its earliest members and the first editor of *The ASTE Journal*, predecessor of *The Tool Engineer*. Throughout the years he has continued to be an enthusiastic booster for ASTE, his outstanding services to the Society being recognized by his election to Honorary Membership and his appointment as Society Historian.

His school originated when he offered to instruct his brother in drafting. The prospective student appeared for his first lesson, accompanied by twelve friends also eager to learn drafting and designing, in a practical manner. At the end of several months their numbers had increased to 70, and Mr. Jones decided to devote his entire time to teaching. Popularity of the school's realistic educational methods, permitting its graduates to be readily accepted by industry, continued to increase. Now, on the eve of its twentieth anniversary, with the old mid-town location outgrown, the institution will move to the up-to-date building being erected at the edge of the city.

Himself an electrical engineering graduate from Tri-State College of Engineering, Angola, Indiana, "O.B.," as the President of D.C.A.S. is known to his associates, is affiliated with SAE, Michigan Industrial Education Society and American Vocational Association.

Architect's drawing of first unit of new building for Detroit College of Applied Science being constructed at Eight Mile Road and Stratford Avenue, Detroit.



Electronically Analyzed Metals

New York—"Electronic Metallurgical Inspection" was presented September 10 to Greater New York Chapter, by P. E. Cavanaugh, Chief Metallurgist, DuMont Electric Laboratories, Inc., Passaic, New Jersey.

P. E. Cavanaugh

In his address, Mr. Cavanaugh described and demonstrated the DuMont Cyclograph, a cathode ray type of instrument used for quantitative and qualitative metallurgical tests on ferrous and non-ferrous metals. Case depth, core hardness, plating or cladding thickness, carbon content, brittleness, and variations under heat-treatment can also be determined by the device, the speaker indicated.

Another phase of electronics was discussed by Theodore A. Hacker, Field Engineer, Federal Telephone and Radio Corporation, Newark, New Jersey, in a slide-illustrated lecture, "Electronic Heat-Treating In The Megacycle Range." Mr. Hacker detailed unusual heating operations being performed by induction heating equipment generating frequencies up to twelve million cycles per second.

T. A. Hacker

NOTICE

News items concerning Chapters and individual members, for insertion in the ASTE News section of the magazine should be sent to Doris B. Pratt, Editorial Offices, The Tool Engineer, 550 West Lafayette, Detroit 26, Michigan.

Carbide Cutting Tools Vital To Victory

Boston, Mass.—In spite of their mistreatment by hastily-trained workers, carbide cutting tools were an important factor in winning the war, according to E. T. Larson of the Norton Company, Worcester, principal speaker on Boston Chapter's September 13 program.

In discussing wartime developments, Mr. Larson spoke of the production of bomber windows 1.5" to 3" thick composed of 5 to 7 layers of glass and plastic, which were bottlenecks in the airplane industry until wheels were developed to cut .030" at 90" feed per minute. Prism blocks for range finders were roughed with 18" metal bonded wheels, and lenses for optical instruments and quartz crystals were cut-off and ground at a rate unheard of before the war, the speaker said.

Porcelain spark plugs for airplanes are centerless ground with vitrified bonded wheels, he continued, forecasting in the near future 90" diamond saws for the marble industry.

The accompanying film, "Grinding Carbide Tools," emphasized that the performance of any carbide tool depended to a large extent upon the accuracy with which it had been ground. Selection of the proper bond—resinoid, metallic or vitrified—was indicated, the speaker giving examples and applications of the choice of various grits.

During the question period it developed that there are four grades of hardness for vitrified wheels and that it is desirable to use the exact grade that cuts freely and economically. Unless there is a generous supply of coolant, dry grinding is indicated, moving the tool across the face of the wheel to expose new area and to prevent heating.

Gadget Speaker was Donald Marten, Shop Manager of Controller Corporation, who demonstrated a deep hole indicator extension, explaining its various applications. Drawings of the tool were distributed to the audience.

The meeting, held at Schrafft's Restaurant, was attended by 129 members.

Bennett Takes Position With Fruehauf Trailer

Detroit, Mich.—George Bennett, former Tool Supervisor, Chevrolet Flint Division, G.M.C., has joined Fruehauf Trailer Company as Assistant to the Master Mechanic.

George Bennett

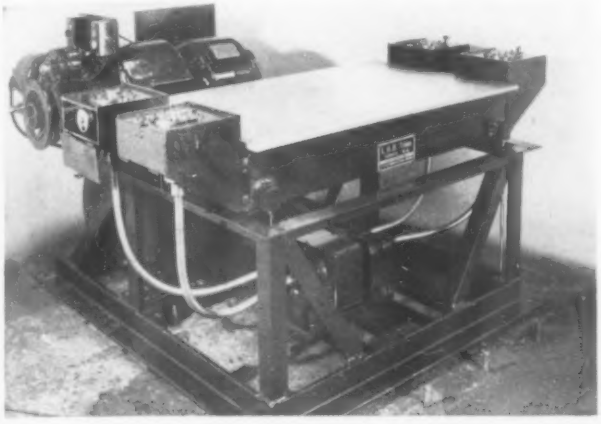
Since 1928 when he came to Flint from Western Steel Products in Duluth, Mr. Bennett has been associated with Chevrolet in various capacities. A graduate of General Motors Institute, he is a charter member and Second Vice Chairman of Flint Chapter, ASTE, which he helped to organize. Previous to the recent chartering of this Chapter he was affiliated with Detroit Chapter.

Support Your Local War Chest Drive

TOOLS OF TODAY

Vibration Test Machine

DESIGNED TO SHAKE out faults in assemblies and components, a new **VIBRATION TEST MACHINE,** by the *L. A. B. Corporation,* Summit, N.J., pretests products by vibration before shipping. Developed under wartime conditions, this machine is now available to manufacturers of consumer products. With this machine, relative displacements of parts may be viewed with a stroboscope.

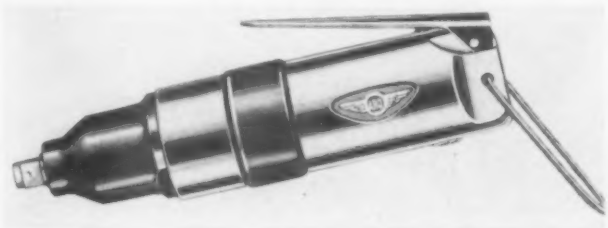


L.A.B. makes two types of vibration testers—a Positive, 3 dimensional type and a Reactive, 2 dimensional. The latter (RV3) has a dural table top 24" x 40¾"—large enough to test several units simultaneously. The table is so mounted that it permits of free vibration in two directions.

Standard frequency range is 10 to 60 cycles per second, with amplitude (⅛" max. excursion at 100 lbs. table load) and direction of vibration adjustable when machine is not running. Loads over 100 lbs. automatically reduces amplitude. An acceleration of 10 G is produced at 40 cycles per second at ⅛" maximum excursion. Load capacity is 400 lbs. maximum.

New ¼" Impact Wrench

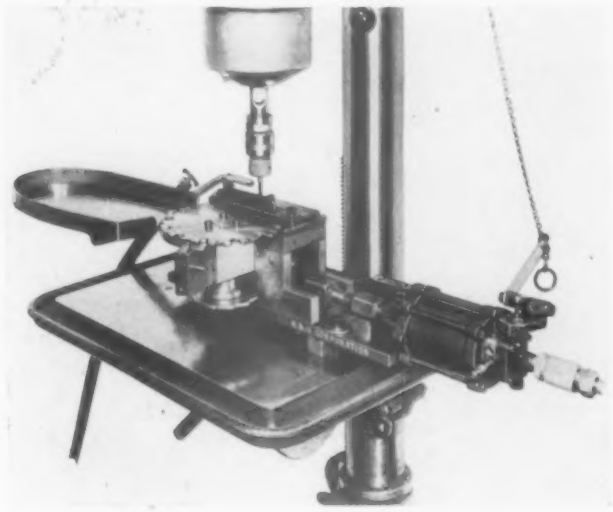
A ¼" CAPACITY **PNEUMATIC IMPACT WRENCH** with straight-type grip and lever control is announced by *The Aro Equipment Corp.,* Bryan, Ohio. Stall-proof in operation, the tool is particularly suited to assembly line nut setting and screw-driving since, through its torque control mechanism, stretching or "burning" of the threads is eliminated. A calibrated adjusting screw enables the operator to set any nut or bolt, within its range, to any desired tension.



New Air Operated Fixtures

A NEW **AIR-OPERATED HOLDING FIXTURE,** which may be used for various machining operations—such as drilling, tapping and milling—has recently been developed by *K & H Corporation,* Fort Wayne, Ind. The fixture illustrated is used to tap nuts, holding them square to the axis of the tap within .001". Output is said to be about 18,000 ¼-28NF3 nuts in an 8 hr. shift.

The entire assembly consists of a double acting air cylinder in combination with a 3 to 1 ratio cam which, on 35 to 40 lbs. air pressure, increases from 4.9 to 1 over regular line pressure. An index mechanism, operating on the return stroke of the cylinder positions the workpieces under the tool and automatically discharges them.



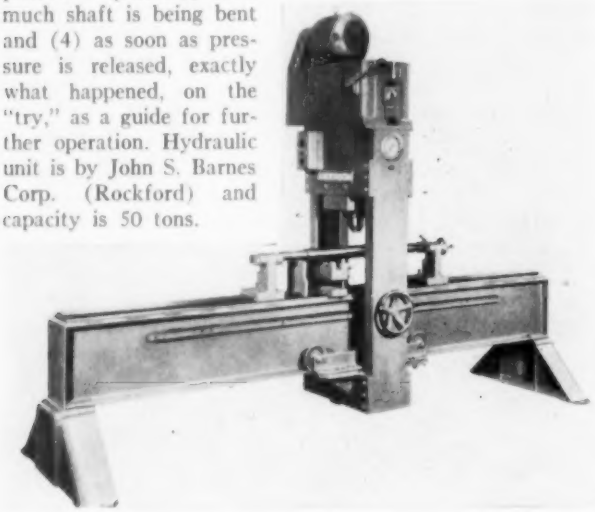
Non-Corrosive Flux

A NON-CORROSIVE flux, known as **ZENITH SUPER FLUX** and produced by *Polan Industries,* Huntington, W. Va., is recommended by the makers as a soldering flux for copper, cadmium, plated brass and bright or black steel, as well as for electrical connections and to facilitate tinning of soldering tips. Originally developed for the armed forces, this flux is now available to private industry.

Hydraulic Straightening Press

A NEW **HYDRAULIC STRAIGHTENING PRESS,** by *Anderson Bros. Mfg. Co.,* Rockford, Ill., has been developed to facilitate the loading of heavy work. With the traveling ram at one end of the press, heavy work may be positioned or removed without interference. The balanced ram assembly moves easily on ball bearing equipped wheels, and the table is provided with a Vee slide on which is mounted spring loaded centers and checking rolls.

An indicator tells the operator (1) the amount of runout; (2) where to stop the shaft for straightening; (3) during pressure operation, how much shaft is being bent and (4) as soon as pressure is released, exactly what happened, on the "try," as a guide for further operation. Hydraulic unit is by John S. Barnes Corp. (Rockford) and capacity is 50 tons.



Improved Tap Reconditioner

TERMED A 4-IN-1 machine, with facilities for full-range chamfering, spiral pointing, point polishing and grinding to full length of flutes, an improved **TAP RECONDITIONER,** by *Detroit Tap & Tool Company,* has increased range and flexibility for the reconditioning of taps from small machine screw sizes up to 1½" diameter. Taps with to 7 flutes can be chamfered, and flutes and spiral points may be ground on taps having 2 to 6 flutes.

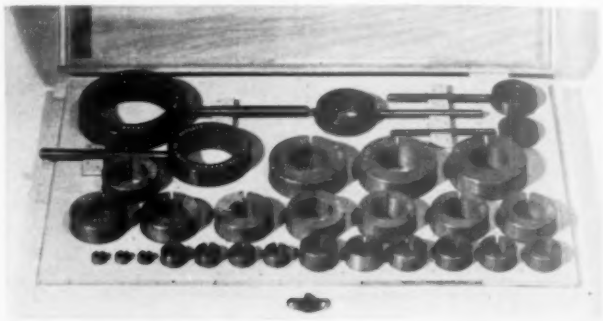
High Speed Lathe File

A LATHE FILE that will cut steels that ordinary files won't touch, and at speeds up to 8 to 10 times faster, is a recent product of *Kennametals, Inc.,** Latrobe, Pa. In addition, life of this file is said to be from 50 to 200 times longer, with an added advantage of longer filing surface.

As seen by the illustration, the file is composed of insets in combination with a light weight, aluminum alloy handle. At present, one size is available—the F-45—which is 13" overall length, with filing surface ¾" wide x 8" long.

Tool Room Lap Set

A TOOL ROOM **LAP SET,** consisting of 24 Cast Iron Laps from ¼" to 1½" inclusive, in steps of ¼", is now available from *American Gagemakers Supply Co.,* 11706 Woodward, Detroit 3. The laps are made from a good grade of cast iron, with holders. The holders are equipped with locking and expanding screws, the latter tapered to fit the laps. The set, complete with 5 holders, is furnished in a substantial wooden box.



New Pratt & Whitney Jig Borer

Pratt & Whitney Div'n of Niles-Bemont-Pond Company, West Hartford, Ct., has announced a new feature on the P & W **NO. 3G JIG BORER**—the largest size machine of this type made by Pratt & Whitney. The new feature is a large non-detachable precision rotary table built right into the machine. Two table sizes are available—42" or 48" in diameter. Thereby, precision boring to polar coordinates may be done in addition to regular rectangular coordinate work. Either type, or both, can be handled without change in set-up.

The rotary table, which is equipped with a precision worm indexing mechanism which provides excellent accuracy for average work, replaces the regular, plain rectangular table and is finished to the usual close limits of tolerance of P & W jig borers. For greater peripheral accuracy, the rotary table may be provided with a spacing system on the outer rim. The table is power indexed, in addition to the horizontal and transverse power traverses on the machine slides. Work capacity is large, either machine handling bores on a diameter of 53½". Table top to spindle nose is 24⅛".

New Flash Welding Machine

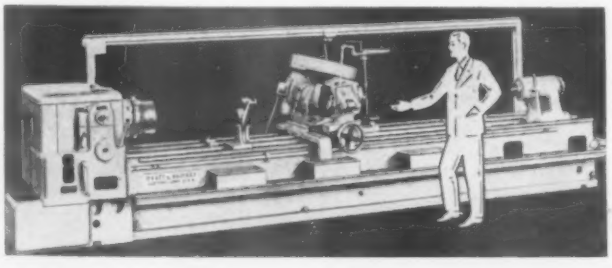
An Entirely New line of **BUTT-FLASH WELDING MACHINES,** ranging in capacities from 21 KVA to 250 KVA, is being produced by *Progressive Welder Company,* 3050 E. Outer Drive, Detroit 12. This range comprises 5 basic sizes, each classified and rated according to recommended specifications of the Resistance Welder Mfgrs. Assn.

Design permits the machines to be furnished for hand, air, hydraulic or motor operation, as desired; and control can be manual or semi or fully automatic. Work clamping fixtures may be operated by one method and platen traverse by the same or another method. Thus, work clamping may be air or hydraulically operated, while the flash and upset can employ one or the other without any change in basic design.

Another feature is the slanting and easily accessible platen and work holding fixture, making for visibility and ease of loading and operation. Incidentally, both hydraulic and timing adjustments are readily accessible, from the right side of the machine, through a tamper-proof door.

New Large Thread Miller

A New Large thread miller, with capacity for thread milling up to 12″ diameter and available in bed lengths with center distances 30″, 60″, 90″, 120″ and 168″, and known as the **UNIVERSAL MODEL "C" THREAD MILLER,** is announced by the *Pratt & Whitney Division* of Niles-Bement-Pond Co., West Hartford, Ct. The illustration shows the longest bed and an overhead trolley system, furnished on the three longest machines, for carrying power to the center head.

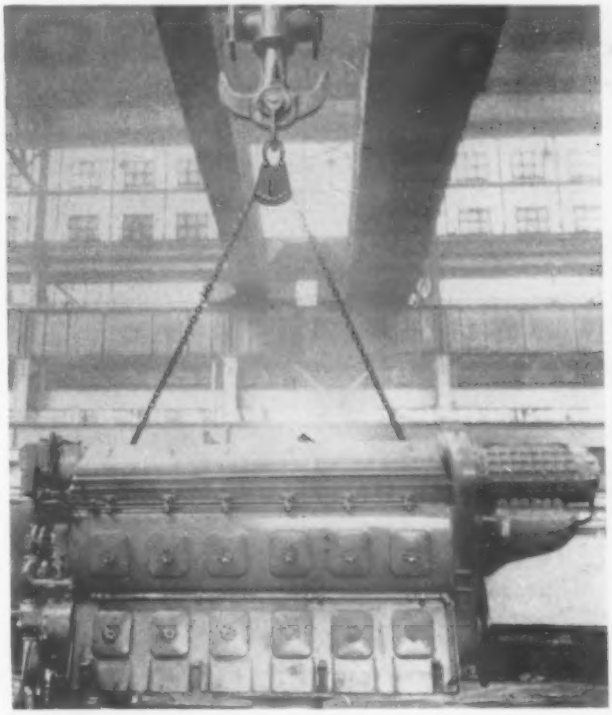


Three motors furnish power; a 7½ HP for the cutter drive, a 3 HP motor for the work spindle and the third for the coolant pump. Basically, design incorporates the general principles of the P & W thread miller line, but there are a number of design improvements and new features. For example, this machine is designed for "climb" milling, with suitable speed and feed ranges for this faster method. However, the speed range permits conventional cutting when so desired.

Safety Equalizing Chain

Automatically Equalizing chain slings—called **SAFE-T-LIFT** and manufactured by *Hercules Sling Co.,* Rockford, Ill.—may be had in capacities of 4, 7, 14, 25 and 40 tons. The safety factor is 4½ to 1 over designated load.

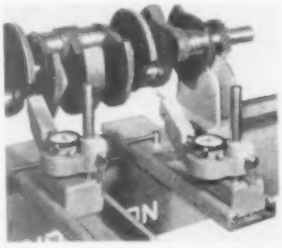
Operation of the Safe-T-Lift, which should be of especial interest to plant safety engineers and others concerned with heavy load lifting, is extremely simple. The crane operator spots the hook over the approximate center of gravity of the load, when the crane hooker (floorman) attaches the chain legs to the load. As lifting power is applied, the sling chain automatically adjusts itself through the equalizing unit.

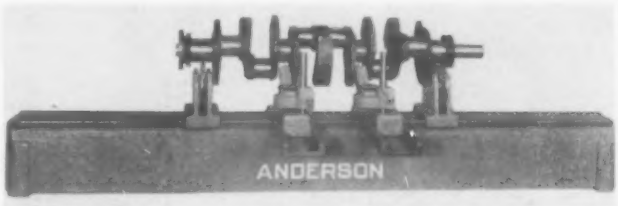


Roto Checker For Crank Shafts

A special **ROTO-CHECKER,** for speeding up the operation of checking crank shaft bearings, has been developed by *Anderson Brothers Mfg. Co.,* Rockford, Ill. The crankshaft to be tested is placed on four rotating discs and a number of indicators are brought into position and the crankshaft is revolved. One indicator can be furnished for each bearing.

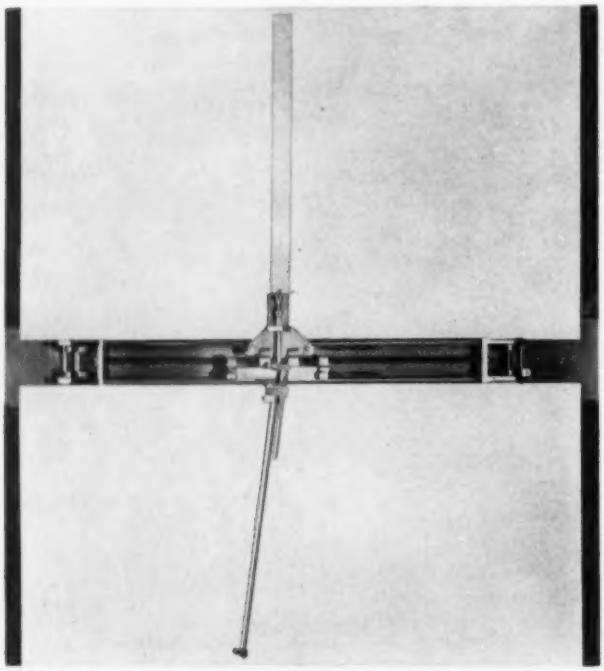
The discs are free rolling on accurate and highly sensitive ball bearings of Anderson design. The bases are made in two lengths—42″ and 64″. However, larger Roto-Checkers can be made to suit customer specifications, or for special work. The units can also be used to check static balance.





Perspectives by Stereograph

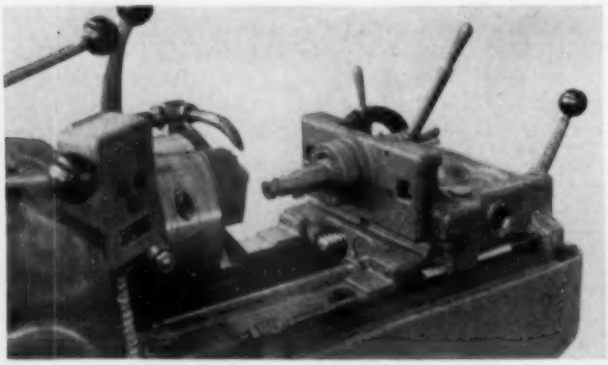
CLAIMED AS NEW and entirely different, the Pomeroy **STEREOGRAPH PERSPECTIVE DRAWING MACHINE** greatly simplifies and facilitates the making of perspective drawings. The machine can produce a perspective, as stereoscopic pairs showing length, width and depth, or—if desired—as a single perspective drawing. Drawings can be made to scale.



The machine, which is sturdily constructed, can also be used to produce third dimensional graphs to create space curves and, also, to show internal construction (as in shadowgraphs) of complicated machines and mechanisms. Descriptive literature may be had from *Pomeroy Stereograph Co., Inc.*, 1783 E. 11th St., Cleveland.

Special Holding Fixture

A special **HOLDING FIXTURE** has been developed by the *Landis Machine Company,* Waynesboro, Pa., for use with the Landmaco Threading Machine. While the fixture shown was designed for threading fuze adaptors, it can be widely applied to other products. The fixture, which provides for very close limits of tolerance, has an arbor which centers the workpiece and aligns it with the spindle. The entire unit is applied to the standard machine carriage, with horizontal and vertical adjustment to assure perfect and permanent alignment.



New Di-Acro Bender

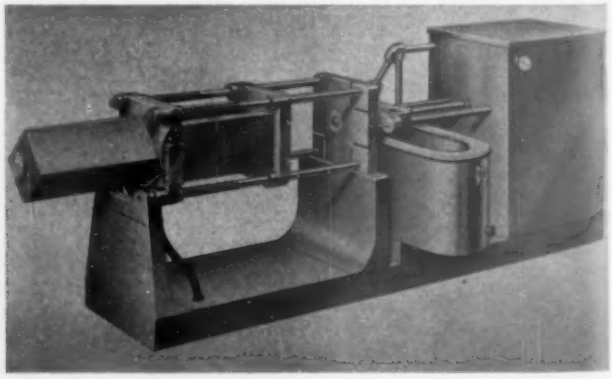
THREE NEW MODELS of ***DI-ACRO BENDERS***—Nos. 1, 2 and 3—manufactured by *O'Neil-Irwin Mfg. Co.*, Minneapolis 15, incorporate redesigns and improvements that greatly enhance their operation. Operating friction has been reduced by the installation of Torrington roller bearings, and an instantly reversible lever control cam, on the No. 2 and 3 models, allows the operator a choice of left or right hand forming direction.

These benders are versatile and may be arranged right on the job to accurately bend rod and tubing of various cross sections. For example, rectangular bus bars may be formed flat or edgewise, as desired. A 40-page Bulletin, which fully describes these tools, may be had from the makers.

Automatic Die Casting Machine

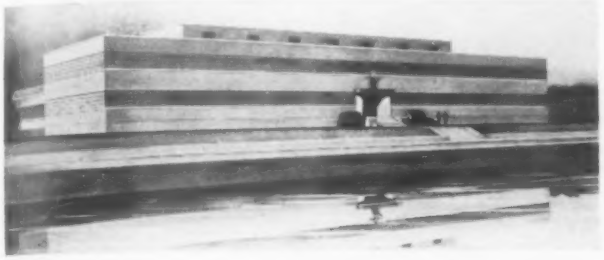
A new line of high speed, **AUTOMATIC DIE CASTING MACHINES** has been developed by *H. L. "Red" Harvill*, a pioneer in the die casting process on the West Coast. Four basic machines are included, with various sizes available in each. The second of these (shown) is the HDA series of automatic air operated machines for casting zinc, tin and lead alloys, which departs from the conventional "gooseneck" injection method commonly used for casting nonferrous metals.

Rather, the Harvill machine embodies a metal feeding device which feeds a continuous stream of the molten alloy into a horizontal injection chamber. Injection, into the die cavity, is by an air operated ram with potential pressure of 1400 p.s.i. during the period of solidification. Sizes now available will accommodate a die range, horizontally, from 12″ to 24″, with vertical dimension 8″ in the smallest size. Capacities run from 6.1 lbs., in the HD-2A1 to 21.2 lbs. in the large HD-4A1.



North East West South in Industry

ALLEGHENY LUDLUM STEEL CORP'N, will erect a $2,000,000 ultra-modern Research Laboratory and Experimental Center adjacent to its headquarters plant at Brackenridge, Pa. With the new facilities, an intensified research will be brought to bear on the highly specialized stainless, magnetic, valve, tool and other complex steels produced by the company. The lab will include every facility for experimental work.



LEPEL HIGH FREQUENCY LABORATORIES, Inc., of 39 W. 60th St., New York, has acquired the induction heating division of the **VAN NORMAN COMPANY,** of Springfield, Mass. The Lepel Lab, which maintains facilities in major industrial centers in the U.S. and Canada, will henceforth handle all sales, service and maintenance of Van Norman units.

Cross

E. G. Cross has recently been appointed supervisor of the Production Planing and Control Department of the Crocker-Wheeler Division of the Joshua Hendy Iron Works, Ampere, N. J. Mr. Cross, who has had an unusually wide experience in the industrial management field, is a graduate of Franklin and Marshall College, Lancaster, Pa., and took post graduate studies at University of California and New York University.

THE VASOLOY-RAMET CORP'N, of No. Chicago, Ill., is now carrying stocks of standard carbide tools and blanks at strategic points in order to facilitate deliveries. For example, the Detroit branch office, now located in the Book Bld'g, with A. R. Conti in charge, carries a full line of these tools as well as bits, cut-off blades, shell end mills and other tools of Tantung.

Robert W. Burgess has been appointed plant manager of Service Machine Company, Elizabeth, N. J. He was formerly instructor in Tool Engineering at Rutgers U. and for a number of years director of tool design at Mack Truck Co. Other appointments include Fred Menning, purchasing agent; Clarence Brittain, head of tool processing, and Allen G. Burdett, made executive vice president.

The **Heppenstall Company,** Pittsburgh, is investing approximately $170,000 in a new laboratory, to be located directly opposite the company's plant at Hatfield and 46th St. According to R. B. Heppenstall, president, the lab will be devoted exclusively to the development of new products and the improvement of current items of manufacture.

COOPER ALLOY FOUNDRY COMPANY has established a subdivision—the **PRECISE CASTING CORP'N,** at 123 Van Buren St., Newark, N.J.—to be devoted exclusively to precision casting of small, intricate parts.

Announced by W. H. Eisenman, nat'l sec'y of the Society for Metals, **Dr. Taylor Lyman** has been appointed editor of the A.S.M. metals handbook. Dr. Lyman who is broadly experienced in technical and educational fields will also serve as secretary of the Metals Handbook Com'tee, and as editor of the annual Buyers' Guide and Data Book.

Wright

As announced by **Allegheny Ludlum Steel Corporation,** Brackenridge, Pa., **T. A. Moorman** has been appointed manager of the company's Forging and Casting Division, at Ferndale, Mich. A native of Cincinnati, and a graduate of Ohio State U. Mr. Moorman was one of the original founders of the F. and C. Division, and, except for the past two years, when he served as manager A. L. Los Angeles plant, has been associated with it ever since.

All operations of **CHANDLER-EVANS CORPORATION,** are being moved to the plant of **NILES-BEMENT-POND,** parent company, at West Hartford, Conn. There will be no change in the separate identity of the company.

Gustafson

At the same time B. H. Gilpin, vice president and general manager of CECO, announced the appointment of Alexander M. Wright as assistant general manager, and Floyd C. Gustafson, director of field and service engineering, as sales manager of its corporation. Mr. Wright, who has been manager of the CECO Dayton plant since 1942, is a native of New Zealand, where he received an engineering degree. He was previously connected, in engineering and executive capacities, with Westinghouse Electric Corporation, Reading R.R. and Carnegie-Illinois Steel Corporation.

Moorman

Mr. Gustafson, a native of Chicago, was educated at Northwestern Military Academy and the School of Engineering, University of Michigan. Joining CECO in 1938, he has since been active in the engineering and development of the company's carburetors, fuel pumps and other automotive accessories.

Messrs. P. D. DeLeo, I. A. Crawford and E. Y. Bunting have recently joined **PROGRESSIVE WELDER COMPANY,** Detroit, as development engineer, research engineer and machine design engineer, respectively. Mr. DeLeo, who is a graduate of Purdue, with a Master degree from Pittsburgh U, was previously with Carnegie-Illinois Steel Co., and recently with Federal Machine & Welder Co. as design and development engineer.

Mr. Crawford was previously manufacturing engineer with Westinghouse Electric Corp'n, specializing in design and applications of equipment for resistance welding. He is author of several outstanding technical papers on resistance welding. Mr. Bunting, whose assignment at Progressive will include designs for new process applications, was previously designing and welding engineer with Federal Machine & Welder Company.

GADGETS

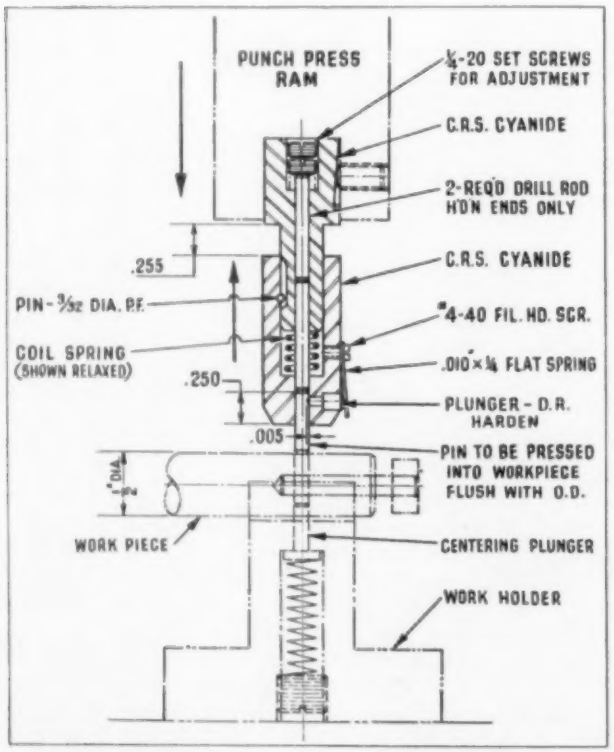
Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Automatic Punch and Holder

THE TOOL ILLUSTRATED is used to insert locking pins in parts as suggested in the drawing. As such, it is practically automatic except that the operator inserts the locking pin into the holder, which completely surrounds the pin, thereby preventing cocking or bending. The action of the holder, as shown by the drawing, is self-explanatory and obvious.

The work holder, which may be half round or a Vee (or shaped to suit the workpiece) is provided with a receding centering plunger, the plunger flushing as the pin is drawn in to full depth. While the accessories shown (as screws, plungers, etc.) are proportioned for a pin approximately ⅛" in diameter, these may be varied to suit the size or shape of the workpiece.

Frank J. Peragine,
Greater New York Chapter,
A.S.T.E.

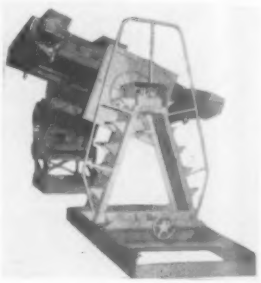


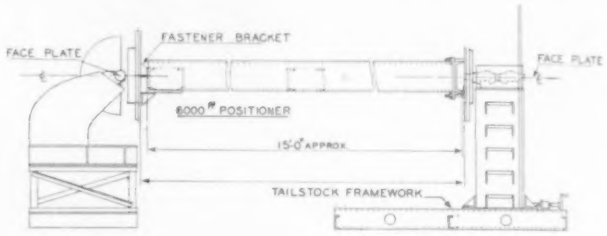
Tail Stock for Large Weldments

In welding long, bulky assemblies on positioners, the overhang imposes so much load on the positioner, as well as on the weldment, that tailstocks are necessary. The tailstock shown was designed and built by Ray F. Lein, designer, and D. F. Lynch, welding technician, the Chain Belt Company, for use with a 6000 lb. capacity positioner. It is constructed almost entirely of welded fabrication and consists of a base framework with machined surface runners and an A-frame pedestal with machined base runners.

An important feature is the set of steps, on either side of the A-frame, with accompanying guide rails, which permits the operator to safely mount the weldment. Another feature is the design of the adaptor brackets, one each being fastened to the tailstock and the faceplate of the positioner. The tailstock can be used for practically any length of weldment, and the positioner can be used independently of the tailstock. A riser under the headstock increases the swing.

By courtesy of The Hobart Brothers Company, Troy, Ohio.



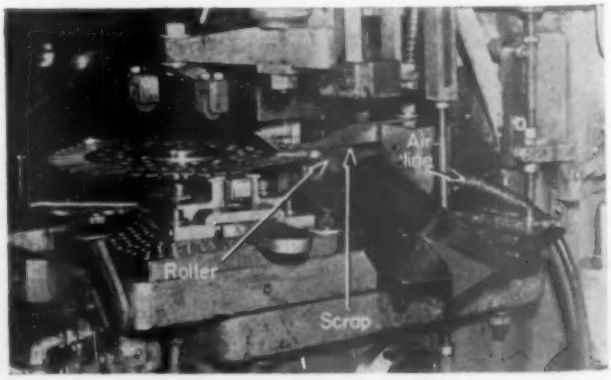


Scrap Ejector for High-Speed Index Press

AN AIR-DRIVEN, roller-type scrap ejector for a high-speed index press, facilitates the punching operation of armature parts for motors from square stock blanks. Formerly, the corner trimmings became wedged, damaging the die and punch and necessitating an additional operation of cutting circular blanks from square stock.

The ejector consists of a rubber roller installed on the press at the point of ejection, and is driven by air supplied through a ⅛-inch pipe. The punchings and trimmings fall upon the roller and are carried to a spillway leading to a scrap box. The roller-type ejector has made the entire operation safer and has reduced production cost approximately 30 per cent.

Robert Harris,
General Electric Company,
Erie Works.



GOOD READING

A Guide to Significant Books and Articles of Interest in the Trade Press

A BIBLIOGRAPHY OF CUTTING METALS, prepared by Orlan W. Boston, professor of Metal Processing, University of Michigan, and published by The American Society of Mechanical Engineers, 29 West 39th St., New York, includes practically every paper, of any importance, on the cutting of metals from 1864 to 1943. The bibliography—which includes European as well as American articles—lists the subject, the author and the publication. With each mention, is a summary of the contents of the article, the whole an invaluable reference that, in compiling, entailed painstaking study and research.

While the work of the preparation fell to Prof. Boston, the listings as a whole were reviewed by A.S.M.E. Special Research Committees on the Cutting of Metals. At a meeting held in '29, the committee included Wm. W. Nichols, Ch'man, Frank C. Spencer, Vice-Ch'man, Fred A. Parsons, Sec'y., Prof. Boston* and Messrs. Carl G. Barth, Bryant H. Blood, Forrest E. Cardullo, Kenneth H. Condit, Adolph L. De Leeuw, T. G. Digges, Ernest F. DuBrul, W. Paul Eddy, Jr., Herbert J. French, Mayo D. Hersey, James A. Hall, John O. Keller, Lewis H. Kenney, Carl J. Oxford * and Willibald Trinks.

A later Committee included M. Martellotti, Ch'man, O. W. Boston, W. C. DeGraff, F. M. Fisher, J. A. Fraser,* T. F. Githens,* W. L. Kennicott,* M. E. Lange, F. W. Lucht,* F. J. Oliver * and C. J. Wiberg. All of the men mentioned are authorities in the field of Metal Cutting.

*A.S.T.E. members who have been prominent in tool engineering—as, for that matter, have a considerable number of the authors of articles listed.

HIGH PRESSURE DIE CASTING, by H. L. (Red) Harvill and Paul R. Jordan, is a comprehensive treatise on the tools and techniques of high pressure die casting. The treatise is unusually complete, and replete with illustrations, and answers practically every question on the process of die casting as far as it has been developed to date. The book is published by H. L. Harvill Manufacturing Company, P.O. Box 335, Vernon, Cal.

The **FEDERAL DIMENSIONAL QUALITY CONTROL PRIMER,** published by Federal Products Corp'n, Providence 1, R.I., furnishes a practical approach to a subject which, while of lively interest, is nevertheless rather confusing to the uninitiated. While the Primer is by no means a complete treatise, it is well prepared and gives the reader a clear insight into what, in the final analysis, is an inspection tool or method. The primer is free, but Work Sheets and Charts, when desired, may be had (in quantity) at normal charges.

Just starting, is a series of **QUALITY CONTROL BULLETINS,** published by Physicists Research Company (Dept. 49), 343 So. Main St., Ann Arbor, Mich. The first installment concerns itself with the Anderometer, an instrument developed by P. R. Co. for the production checking of ball bearings. Bulletin No. 1 indicates value, not only to bearing manufacturers, but to designers and users. The bulletins are triple punched for filing in standard binders.

The 1945 **IDEA BOOK,** published by Modern Industry, 347 Madison Ave., New York 17, is just what the name implies—a booklet chock full of good ideas.

THE STORY OF THE DIESEL is a booklet, published by the Diesel Engine Manufacturers Ass'n., 1 N. LaSalle St., Chicago 2, which gives an interesting account of the operation of Diesel engines and their application in various fields of industry. It should be of especial interest to younger men who are alive to opportunities in a broadening field of endeavor. The booklet is free to the interested.

NEW DEVELOPMENTS IN ALUMINUM BRAZING is an article by Mike A. Miller in September *Metal Progress* dealing with various techniques and procedures in connection with the brazing of aluminum alloys. Since the commercial brazing of aluminum is comparatively new—it was first described by G. O. Hoglund about six years ago—the article is timely and describes the latest developments.

PATENT STUDY INVOLVES NATIONAL SECURITY, an article by Stanley E. Cohen in September *Industrial Marketing*, is a late survey that questions corporate and private control. The article discusses current patent practices and brings up pertinent questions regarding the relationship between inventors and employing corporations or research laboratories.

TIME ALLOWANCES FOR DRILL PRESS WORK, an article by C. T. Post in Sept. 20, *Iron Age*, is broadly informative on the techniques of drilling, spot facing, chamfering, tapping and stud setting. Best types of drill points for various materials are illustrated, with recommendations for reconditioning, and time elements are also comprehensively treated.

METRIC THREADS, by John Gaillard, M.E., American Stds. Ass'n, in September *Screw Machine Engineering*. This is particularly timely in view of the fact that screw thread interchangeability has become an international problem and is now being seriously discussed in international conferences being held for the purpose of standardization.

STRETCH FORMING OF ALUMINUM by Gilbert C. Close in September *Modern Machine Shop*, deals with the advantages of the stretch-forming method of shaping parts. The techniques discussed are of special interest to tool engineers having to do with the forming of sheet metal.

LATIN AMERICA'S INDUSTRIAL EXPANSION BOOSTS DEMAND FOR MACHINE TOOLS. By J. Seward McCain and George Loinaz in Sept. 13 *American Machinist*. A broad analysis, based on two careful surveys and industrial investigation in a number of these nations indicate a heavy potential demand for machine tools in Latin America.

SPECIAL SHAPE BAR—WHAT IT OFFERS THE DESIGNER, by Richard K. Lotz in September *Machine Design*. A thought provoking article replete with good ideas on the use of special bar shapes for the economical fabrication of parts.

PLANNING FOR EFFICIENT PRODUCTION, by Henry E. Rossell in September *Supervision* is a carefully considered article on the organization and scheduling of work through the factory. As shown, improved organization allows foremen more time for employee relations and tends to promote industrial harmony.

Bulletins and Trade Literature

Items briefed herein have been carefully selected for their interest and application. Unless otherwise stated, all are available, free, from the stated sources.

PRATT & WHITNEY Div. of Niles-Bement-Pond Company, West Hartford 1, Ct., has issued a condensed Catalog which, for the first time, shows under one cover the complete line of P & W *precision gages, small tools and machine tools.* The book contains 72 pages of information particularly timely in view of present reconversion.

BEHR-MANNING, Troy, N.Y. has issued a bulletin *"Plus" Factors in Belt Grinding and Finishing with Idler Backstands.* The bulletin gives timely information on belt abrasives and their use.

Bulletin No. 632 and 861-4B-45, respectively describing *"Cone Drive in Machine Tools"* and the latest *Model 861-4B Fine Pitch Rotary Gear Finisher*—the latter for rapid finishing of small gears by shaving—are now available from **MICHIGAN TOOL CO.,** 7171 E. McNichols, Detroit 12.

A new line of Gerotor Air Cylinders and Air Valves is illustrated in *Catalog No. 50,* by **GEROTOR MAY CORP'N.,** Logansport, Ind. In addition to seven models, details of no-tie-rod is shown; also, a newly designed high-speed cylinder of aluminum alloy.

A new Bulletin by The **BELLOWS CO.,** 861 East Talmadge Ave., Akron 10, O., describes the Bellows line of *air motors* and shows installations as applied for various industrial purposes.

A new catalog by **WAGNER ELECTRIC CORP'N.,** 6400 Plymouth Ave., St. Louis, 14, describes the various *Electrical* and *Automotive* products of the company.

"MODERN TECHNIQUE FOR TRUING AND DRESSING WITH DIAMOND WHEELS" is an interesting, vest pocket booklet issued by Golconda Diamond Products Corp., 3418-24 No. Knox Avenue, Chicago 41, which is replete with useful information and shows recommended procedure charts for almost all types of production grinding. The books are complimentary to any concern that uses diamond tools.

"THE TOOL STEELS OF ALLEGHENY LUDLUM"

A 170 page, pocket size book—really a combined catalog and manual—is now available from the **ALLEGHENY LUDLUM STEEL CORPORATION,** Brackenridge, Pa. The catalog contents provide a very comprehensive coverage of tool steels for all uses and all users, while the manual is liberally illustrated and, in addition to treatment of the steels described, contains many pages of technical data. Thumb indexing and sectional arrangement, plus a full general alphabetical index, makes it easy to use.

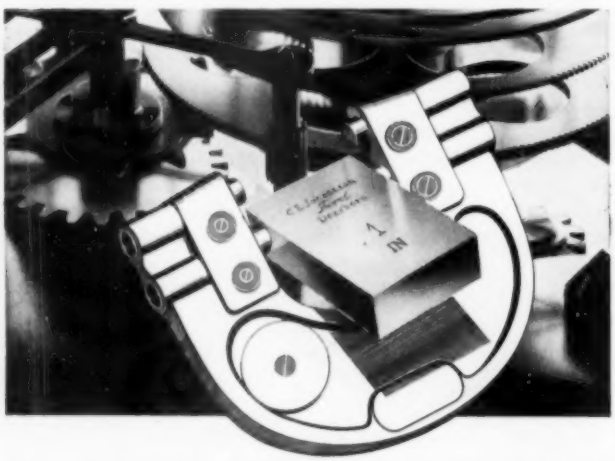
A 24-page booklet on *Tool Steel Drill Rod* by the **CARPENTER STEEL CO.,** Reading, Pa., gives useful information on the selection and heat treating of tool steel drill rod, with complete tables of standard sizes.

A Bulletin by the **UDYLITE CORP'N.,** Detroit 11, gives useful information on *buffing wheels and buffing compositions.*

Bulletin N-1 by **STATE MFG. & CONST'N. CO.,** Franklin, Ohio, describes the line of *Dialset Boring Tools.*

A new 48-page *"Handbook of Metal Sawing,"* distributed by **W. O. BARNES CO., INC.,** Detroit 14, is an unusually complete treatise on metal sawing and is replete with useful information on hand and machine sawing.

Various applications, as well as details, of the Maxitorq Floating Disc Clutches are fully described in *Installation and Data Book No. 45,* by the **CARLYLE JOHNSON MACHINE CO.,** Manchester, Ct.



"JO-BLOCKS" GUARD THOUSANDS OF FAMOUS PRODUCT-REPUTATIONS

A list of manufacturers using genuine Ford Johansson Gage Blocks would include a high percentage of industrial leaders . . . and many who will join the ranks of leadership tomorrow.

For the use of measurement standards of Jo-Block accuracy (4 or 8 millionths of an inch, plus or minus) is a pretty sure indication of determined intent to build a reputation for product-excellence.

Order a master set of Jo-Blocks and Accessories for your plant. We predict you will be very glad you made the moderate investment. Write for new catalog No. 17. Address—FORD MOTOR COMPANY, Johansson Division, Dept. 161, Dearborn, Michigan.

Ford Johansson GAGE BLOCKS

STREAMLINE THE SURFACES

Superfinish

Six Models Of Machines

(Including Lathe Attachments)

For Superfinishing external, internal, tapered and flat surfaces. Also for Superfinishing milling cutters, reamers and cutting tools.

Write for Complete Catalog

OHIO UNITS, Dayton 4, Ohio

Licensed Manufacturers

GET THE MOST FROM YOUR

END MILLS

Elimination of end play in the spindle is particularly important when using end mills. Rake on end teeth tends to pull cutter out of the spindle, letting it hog into the work if not securely held. End mills having shanks of equal or larger diameter than the cutter are recommended.

For maximum production with minimum wear and tear on tools, specify National end mills of proper design for each job.

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DISTRIBUTOR!

Leading distributors in every section of the country have stocks of National Cutting Tools. Every National distributor offers factory trained engineers to serve you. Call your National distributor for cutting tools or any staple industrial product.

NATIONAL

NATIONAL TWIST DRILL & TOOL ROCHESTER, MICH. U.S.A.

TWIST DRILLS
REAMERS, HOBS
MILLING CUTTERS
COUNTERBORES
SPECIAL TOOLS

TWIST DRILL AND TOOL COMPANY

DETROIT AND ROCHESTER, MICHIGAN

Tap and Die Division—Winter Brothers Co., Wrentham, Mass.

Factory Branches • New York • Chicago • Cleveland • San Francisco • Distributors in Principal Cities

TOOL STEEL DATA

Revised data for Oil and Air Hardening Die Steels including types, analyses, uses, hardening characteristics and temperature ranges

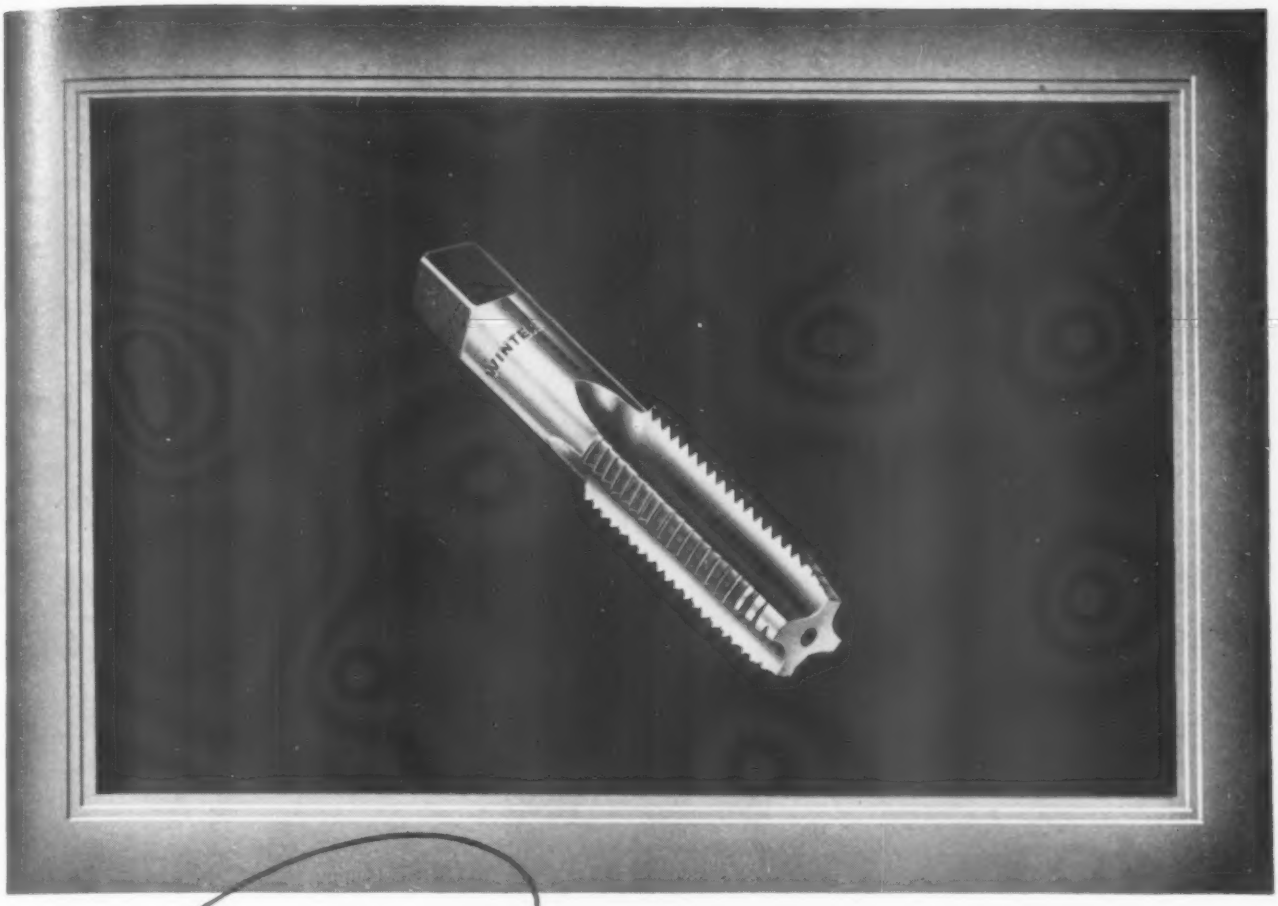
OIL AND AIR HARDENING DIE STEEL CHARACTERISTICS

TYPE	GRADE	ANALYSIS	USES For Cold Work Dies, and Tools Requiring:	HARDENING CHARACTERISTICS	
				HARDENING TEMPERATURES	QUENCH RC
High Carbon High Chrome	SUPERDIE	C 2.10 Si .90 Cr 10.50 W .80	• Close Tolerances • Greatest Production • Best Wearing Ability	Range: 1700° F. to 1750° F. Small or Intricate Sections 1700° F. Large Sections 1750° F.	Oil .....64-66 Air 58-62
High Carbon High Chrome	ATMODIE	C 1.50 Cr 12.00 Mo .80 V .90	• Minimum Warpage • Long Life	Range: 1800° F. to 1850° F. Small or Intricate Sections 1800° F. Large Sections 1850° F.	Air 62-64
Non-Deforming Deep Hardening	OILDIE	C .90 Mn .60 Cr 1.50 W .50	• Accurate Dimensions • Good Cutting Qualities	Range: 1500° F. to 1550° F.	Oil 62-64
Non-Deforming Standard Type	EXL-DIE	C .90 Mn 1.15 Cr .50 W .50 V .10	• Little Dimensional Change • Ease in Hardening	Range: 1480° F. to 1525° F.	Oil 62-64
MARTEMPERING:	The oil hardening die steels can be quenched in hot salts maintained at 400° F. After which they can be cooled in air to room temperature. This will reduce stresses ordinarily set up in this temperature range.				
TEMPERING:	For maximum hardness temper from 350° F. to 400° F. The High Carbon, High Chrome steels can be tempered up to 900° F. where increased toughness is desired, and double tempering is recommended.				
GRINDING:	For grinding use a clean free cutting wheel. For final tool sharpening, a cutter grinder with fine grit such as No. 320, with removal up to .001" will give a fine finish and substantially lengthen the life of the tool.				

COLUMBIA TOOL STEEL COMPANY

MAIN OFFICE AND WORKS — CHICAGO HEIGHTS, ILLINOIS

Branches and Warehouses: CHICAGO • CINCINNATI • CLEVELAND • DETROIT MILWAUKEE



DESCENDENT OF A FAMOUS LINE

You'll like WINTER High Speed TAPS. Like the thoroughbreds they are, they accept the toughest production assignments and come thru with flying colors. Put them on your most difficult—or fussiest jobs and watch them perform. Catalog mailed on request.

DIVISION OF NATIONAL TWIST DRILL & TOOL CO., ROCHESTER, MICH.

Winter Brothers

COMPANY

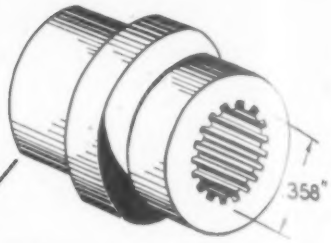
BRANCH STORES:

Wrentham, Massachusetts, U.S.A.

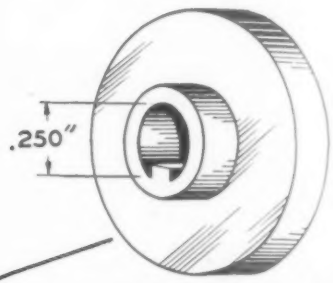
SAN FRANCISCO, CALIFORNIA · CHICAGO, ILLINOIS · DETROIT, MICHIGAN

They're Everyday Jobs for the "Junior"

PULL BROACHING
(With Pull-Down Attachment)

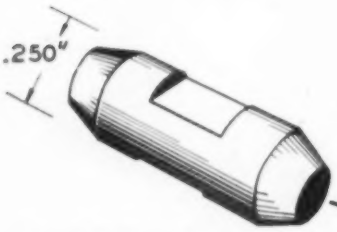


Broaching small splines in lever hubs.

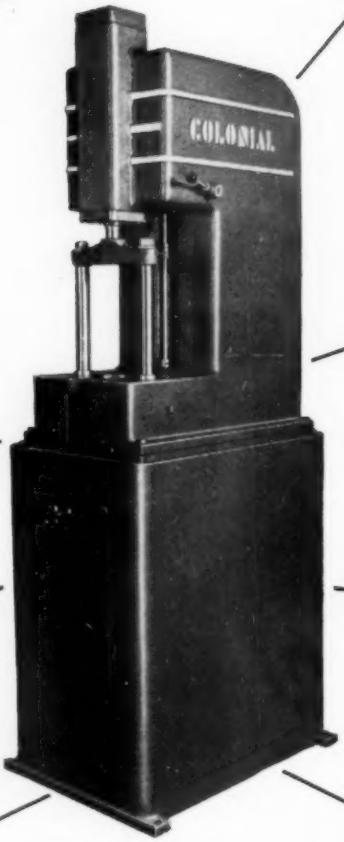


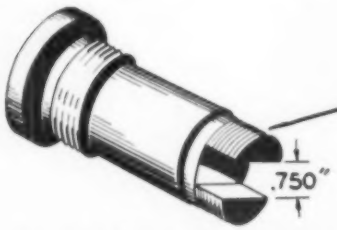
Broaching inverted .062 key in ¼" hole, ½" long.

PUSH BROACHING

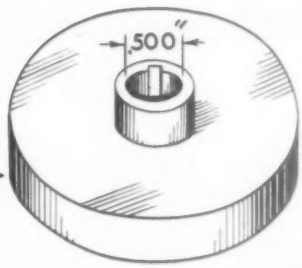


Straddle Broaching ¼" wide flats on ¼" diam. pivot pins.

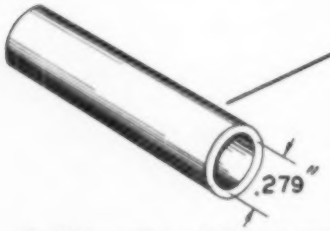




Burring slots in fuse bodies after turning and threading.



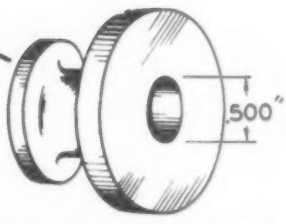
Cutting .155 by .070 keyway ¼" long in ½" hole.



Finishing ID to .002 in 1-½" long seamless brass tubing.

In practically every shop there are "little" jobs—assembly, broaching, etc.,—which the Colonial "Junior" Press—with or without pull-down attachment, base type or bench type—can do quicker and better. Full hydraulic—available with variable speed and pressure controls. Capacities 1 to 4 tons; 12 inch stroke.

Ask for Bulletin #VJ1-44



Removing .004 to finish a ½" hole, ¾" long.

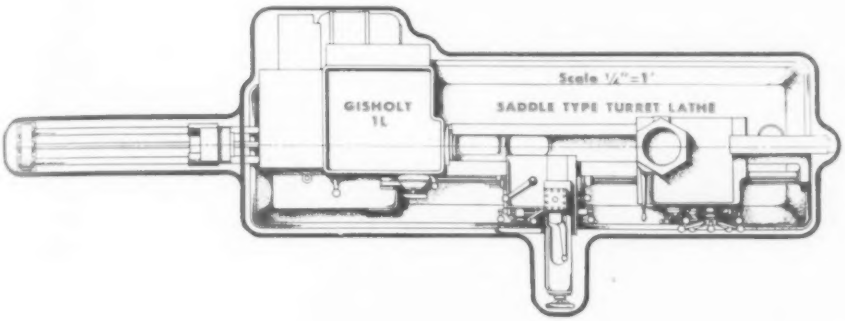
colonial BROACH COMPANY

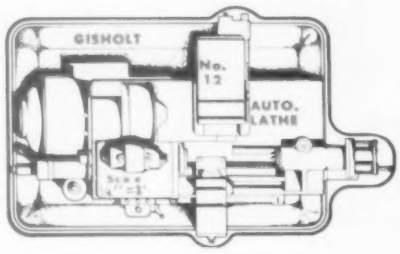
DETROIT 13, U.S.A.

Broaches — Broaching Machines - Broaching Equipment

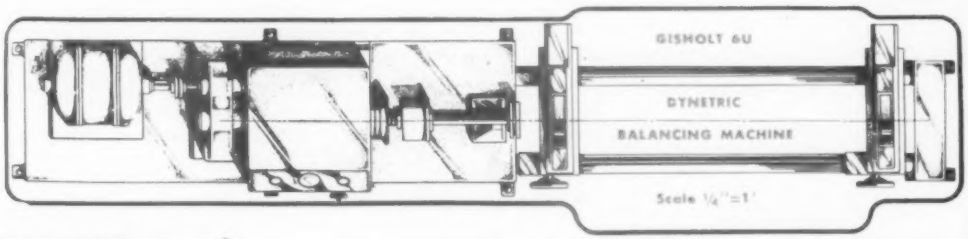
PLANNING NEW PLANT LAYOUTS FOR TOMORROW?

Gisholt is ready to assist with cardboard punchings for each size and type of Gisholt machine. These models—each made to exact scale—enable you to plan the location, or re-location, of machines by simply placing them upon your projected factory floor layout sheets to obtain the most efficient arrangement of machines, more easily. They are available, free of charge, upon request, to all companies preparing for reconversion to peacetime production. Use the coupon below.





The three diagrammatic cut-outs shown here represent the Gisholt 1L Saddle Type Turret Lathe, the No. 12 Hydraulic Automatic Lathe, and the 6U Dynetric Balancing Machine. Made precisely to ¼ inch to 1 foot scale, they eliminate the need for special trips to the shop to obtain accurate measurements of actual machines, or tedious checking of catalog specifications. Similar cut-outs are now available on all sizes and types of Gisholt machines.



USE THIS HANDY COUPON to request models desired

Be sure to indicate the quantity required for each size and type of machine. All requests should be directed to Madison.

Gisholt Machine Company
1215 East Washington Ave.
Madison 3, Wisconsin

Gentlemen:

Please send me, free of charge, diagrammatic cut-outs of Gisholt Machines as indicated below. (Please state number required for each.)

__ No. 3 Ram Type Turret Lathe	__ Simplimatic (Automatic) Lathe
__ No 4 Ram Type Turret Lathe	__ No. 12 Hydraulic Automatic Lathe
__ No. 5 Ram Type Turret Lathe	__ 1S Dynetric Balancing Machine
__ 1L Saddle Type Turret Lathe	__ 3S Dynetr c Balancing Machine
__ 2L Saddle Type Turret Lathe	__ 3U Dynetric Balancing Machine
__ 3L Saddle Type Turret Lathe	__ 4½U Dynetric Balancing Machine
__ 4L Saddle Type Turret Lathe	__ 6U Dynetric Balancing Machine
__ 5L Saddle Type Turret Lathe	__ Dynetric Micro-Balancer

Firm Name .....

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By ..... Title .....

GISHOLT

TURRET LATHES

AUTOMATIC LATHES

BALANCING MACHINES

SPECIAL MACHINES

GISHOLT MACHINE COMPANY
1257 East Washington Ave. • Madison 3, Wisconsin

Look Ahead—Keep Ahead—With Gisholt Improvements in Metal Turning

...and now over 1,100,000 close-tolerance* gagings from that ELGIN Sapphire Gage!

STEWART-WARNER REPORTS

SAPPHIRE OUTWEARS STEEL MORE THAN 7000 to 1!

*GAGING SHAFT GROUND TO .001 TOLERANCE

Double Ring Sapphire Gage—Used continuously right off the grinders

The Elgin Gage is used "right on the line"—no babying—month after month by Inspector A. N. Nathan. In over a year of continuous usage the gage has required no servicing.

While outwearing 7000 steel gages and 1200 carbide gages, this company—and others, too—have **SAVED** Replacement Gage Costs—Worn Gage Rejects—Gage Checking Time—Production Supervisory Time while **INSURING** continuous, uninterrupted **PRODUCTION.**

Inert, chemically stable ELGIN SAPPHIRE is dimensional fidelity personified. Check the SAVINGS Elgin Sapphire can make for you—even on short runs.

America's best equipped Sapphire Fabricator

Elgin National Watch Company
SAPPHIRE PRODUCTS DIVISION

932 Benton Street, Aurora, Illinois

★ELGIN★ *Sapphire Gages*

DIMENSIONAL FIDELITY IN GAGING OPERATIONS

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Dist. Eng.,
1030 Sherman Street

CLEVELAND, OHIO
Production Tool Co.,
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DETROIT, MICHIGAN
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838 Maccabees Building

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Announcing
PLAN-O-MILL Number 1

FOR INTERNAL AND EXTERNAL MILLING AND THREADING

- Mills and threads in one revolution . . . a complete part in as little as 8 seconds.
- Occupies less than 9 square feet of floor.

NOW YOU CAN HAVE milling accuracy with tapping speed. In Plan-O-Mill Number 1 all the recognized advantages of planetary milling and threading are provided in a compact, space-saving size designed especially for rock-bottom overhead and operating cost. It embodies all of the well-known Plan-O-Mill labor-saving features, including push button operation, simplicity of set-up, and Thy-Mo-Trol electronic feed control—engineered by General Electric and pioneered by Plan-O-Mill—for complete, split-thousandth control of feed-in and feed-around.

Plan-O-Mill Number 1 saves space—requires less than 9 square feet of floor.

Plan-O-Mill Number 1 is fast. It mills in one revolution—a complete part in as little as eight seconds!

Plan-O-Mill Number 1 is versatile. It handles any size part—even parts larger than the machine itself—because the part does not revolve.

Plan-O-Mill Number 1 requires no special skill to operate. Adjustments for wear, for size and character of work are easy to reach and easy to make.

Find out today how this new machine can make your operation more efficient and profitable. For details, contact your machinery dealer, or write direct.

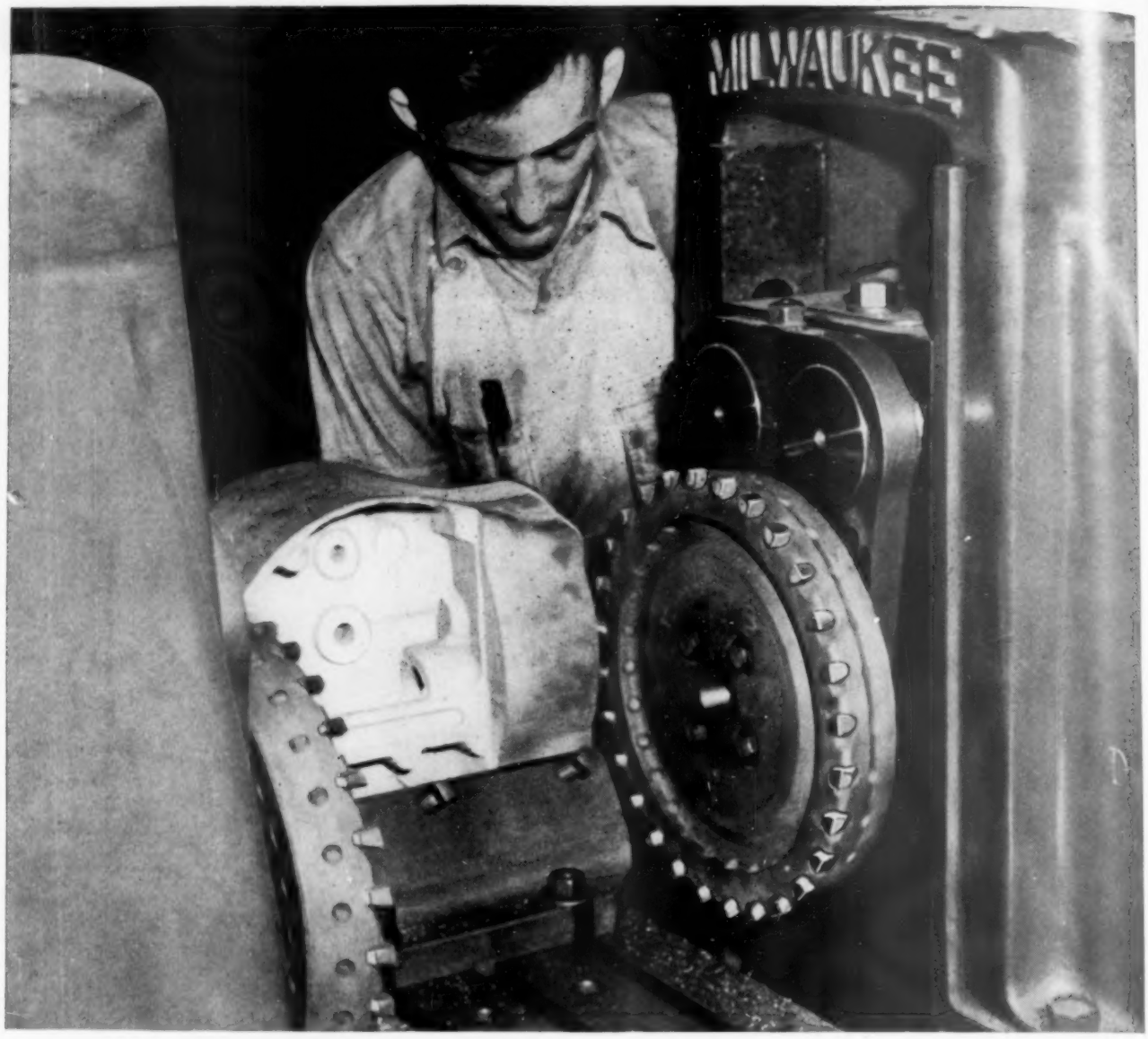
5 FIRSTS BY PLAN-O-MILL

- *First to install General Electric's remarkable new Thy-mo-trol electronic feed control!*
- *First planetary to mill external threads with standard multiple thread cutter!*
- *First planetary to coordinate feeds and speeds!*
- *First to provide absolute control of feed-in!*
- *First to offer a practical, low cost carbide thread milling cutter!*

PLAN-O-MILL CORPORATION
1511 E. EIGHT MILE ROAD
HAZEL PARK, MICH.

THREAD AND FORM PLAN-O-MILL MILLING MACHINES

THREAD AND FORM PLAN-CO MILLING CUTTERS



LOVEJOY TYPE "A" FACE MILLING CUTTERS FOR *Medium Duty*

Tool popularity goes with ability to produce consistently—easily—accurately. This, plus positive-locking blades, has made the Lovejoy Type "A" face mill a favorite in production plants and tool rooms requiring *medium duty* cuts. All blades are *positive-locked* in the forged steel housings at the correct cutting angles. This eliminates breaking stresses, and gives exceptionally free cutting qualities. Lovejoy blades of HSS, tungsten carbide, and cast alloy are interchangeable over a wide range of sizes. Shell end, Type "A" cutters are available for National Standard and Lovejoy Standard arbors, and the Type "A" can be supplied for any spindle mounting. For full information, prices, and specifications on the Type "A" and all other Lovejoy milling cutters, boring heads, boring bars, etc., write for Catalog No. 27.

LOVEJOY TOOL COMPANY, Inc., Springfield, Vt.

P & J EQUIPMENT CAN BE RE-TOOLED . . . FOR FURTHER LOW-COST PRODUCTION

The need for cost-cutting in the era which lies ahead can be met with existing P & J equipment, because P & J design is such as to facilitate re-tooling. Thus a P & J machine, such as the 6 DRELX shown here tooled for machining brake drums, can be readily changed over for producing any other parts which come within the scope of its capacity. The new work will be handled at minimum cost.

Practically every P & J machine now in service offers an opportunity to be of further, low-cost productive use. Now is the time to consider the part your P & J equipment can play *profitably* in your reconversion program. P & J engineers are at your command to help you re-tool to greatest advantage.

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

"U. S." Stands for "UNCONDITIONAL SURRENDER" Buy More BONDS

P & J REBUILDING SERVICE Owners of P & J Automatics are invited to investigate P & J's plant facilities for rebuilding their machines to original accuracy and productivity. Re-tooling can be conveniently handled at the time of rebuilding.

POTTER & JOHNSTON MACHINE CO.
PAWTUCKET, R. I.

MASS PRECISION AND SIMPLICITY

The key to Mass Precision is simplicity—simplicity of design in every part and in the complete assembly; simplicity of design in tools, jigs and fixtures; simplicity of methods for every step in production; simplicity of gaging.

Simplicity is not easy to achieve. Many manufacturers, for the past 40 years, have depended on Nichols to build assemblies that require precision tolerances. Equipment, methods and experience are the factors that qualify Nichols to produce such assemblies in volume at prices that meet competition.

A study of your requirements may show that Nichols can do the same for you. A free copy of "Mass Precision" is yours for the asking.

W. H. NICHOLS & SONS, 48 WOERD AVE., WALTHAM, MASS.

ni

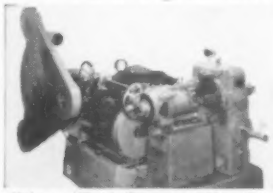
"Accurate" Nichols

PRECISION ENGINEERING AND MANUFACTURING FACILITIES FOR MASS PRODUCTION

Oilgear Fluid Power extends range of amazing wire coating machines

The John Royle & Sons tubers are amazing machines that are coating millions of feet of wire with rubber or plastic insulation each week to meet the exacting requirements of the Signal Corps. Previously, not one of these tubers could produce its full capacity; the mechanical transmissions with which they were equipped originally just were not broad enough in their speed range to permit *one* standard tuber to coat *many* different sizes of wire uniformly with the required thickness of rubber or plastic.

But Oilgear Fluid Power could meet that need . . . and did. The Oilgear Transmission gives a broad range of controlled speeds to the capstan and rewind drive of this machine, enabling the latter to handle more sizes of wire and to do a much better job of coating the wire it handles. Similar benefits can be yours . . . if you will investigate the amazing possibilities of Oilgear Fluid Power for your straight line feeds or rotary drives. No matter what your power transmission problem is, you should know what Oilgear can do. THE OILGEAR COMPANY, 1308 W. Bruce St., Milwaukee 4, Wisconsin.



Oilgear Fluid Power enables this John Royle & Sons tubing machine to process many sizes of wire with required thicknesses of coating.

ARE YOU TRYING TO:

1. Apply large forces through long . . . or short . . . strokes at variable speeds?
2. Obtain automatic work cycles, variable speeds in either direction . . . with or without preset time dwell?
3. Apply large forces through continuous or intermittent reciprocating cycles at constant or variable velocities?
4. Obtain extremely accurate control of either position or speed of a reciprocating member?
5. Apply accurately variable pressure either static or in motion?
6. Closely synchronize various motions, operations or functions?
7. Apply light . . . or heavy . . . forces at extremely high velocities through either long or short distances of travel?
8. Obtain continuous automatic reversing drives at constant R.P.M. or over a wide range of speed variation?
9. Obtain accurate remote control of speed and direction of rotation, rates of acceleration and/or deceleration?
10. Obtain constant horsepower output through all or part of a speed range?
11. Obtain automatic torque control?
12. Obtain accurately matched speed of various rotating elements?
13. Obtain constant speed output from a variable speed input?
14. Obtain full preset automatic control, elimination of problems of shock, vibration, etc.?

You Need Oilgear!

OILGEAR Fluid Power

YOUR GEAR CUTTERS WILL DO

Unless designing gear cutters for every kind of job is second nature to you, it is easy to overlook little things like the fact that an .050" radius on a hob tooth will cut one size of fillet on one size of gear, another size of fillet on a different gear. Or that a shaper cutter with a 14-1/2° pressure angle in the normal plane will not produce a 14-1/2° pressure angle gear due to the sharpening angle. Or that you use the poorest part of the steel for cutting when you design the tool with the shank larger than the hob; or that you usually don't need a Class A hob when a gear is finished by shaving; or that a correctly designed hob protuberance will leave no undercut on gear teeth after finishing.

Obvious? Certainly. Yet these items are taken at random from scores of little things brought to the attention of tool purchasers by Gear Production Headquarters' Engineering Department after the order has been received.

For G-P-H engineering goes beyond designing or selecting a tool to your "order". It analyzes your requirements on the basis of experience in every phase of gear production BEFORE THE TOOL IS MADE.

If it's a G-P-H-engineered gear cutting tool, it is the right tool for the job.

Are you on the Mailing List to receive GEAR PRODUCTION HIGHLIGHTS, regularly? Ask for it on your company letterhead.

ORIGINATORS of GEAR SHAVING

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD DETROIT 12, U. S. A.

BUY U.S. BONDS STAMPS

RED CUT SUPERIOR

TUNGSTEN	CHROMIUM	VANADIUM
17.50—18.50%	3.75—4.25%	.95—1.15%

6-6-2

TUNGSTEN	MOLYBDENUM	VANADIUM
5.50—6.00%	4.50—5.00%	1.40—1.75%

VASCO M-2

TUNGSTEN	MOLYBDENUM	VANADIUM
6.00—6.75%	4.75—5.25%	1.75—2.05%

8-N-2

TUNGSTEN	MOLYBDENUM	VANADIUM
1.30—1.80%	8.00—9.20%	.90—1.30%

Four leading types of General Purpose High Speed Steel by the Nation's leading Producer of Fine Tool Steel. Ask us to help you select the type best suited to Your needs.

Vanadium-Alloys STEEL CO. LATROBE, PA.

Colonial Steel Division • Anchor Drawn Steel Co

NOW IT'S EASY TO IDENTIFY COATED ABRASIVES BY "CARBORUNDUM"

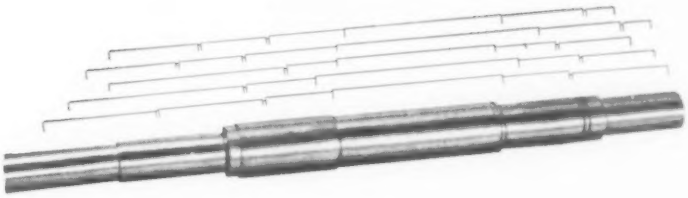
"CARBORUNDUM" has put its simplified identification system for coated abrasives into effect. Now it is easy to order these products. First the product is called by its right name—the name of the end use. Second that name and the specifications appear on *both* the package label and the backing material. The man in the shop can easily tell what he is using and requisition more. The stockroom finds it quicker and easier to locate the requisitioned material. The purchasing department eliminates trouble in duplicating previous orders. For complete information, please refer to our new, authoritative coated abrasives book, "Sanding & Finishing." If you have not yet received your free copy, please write The Carborundum Company, Niagara Falls, New York.

THERE IS A PRODUCT BY
CARBORUNDUM
TRADE MARK
FOR EVERY ABRASIVE APPLICATION

("CARBORUNDUM" is a registered trade mark of and indicates manufacture by The Carborundum Company)

Compare the ACME-GRIDLEY AUTOMATIC

with a Special Shaft Machine



The requirements of this motor shaft are high precision, a high degree of concentricity, smooth finish and low cost.

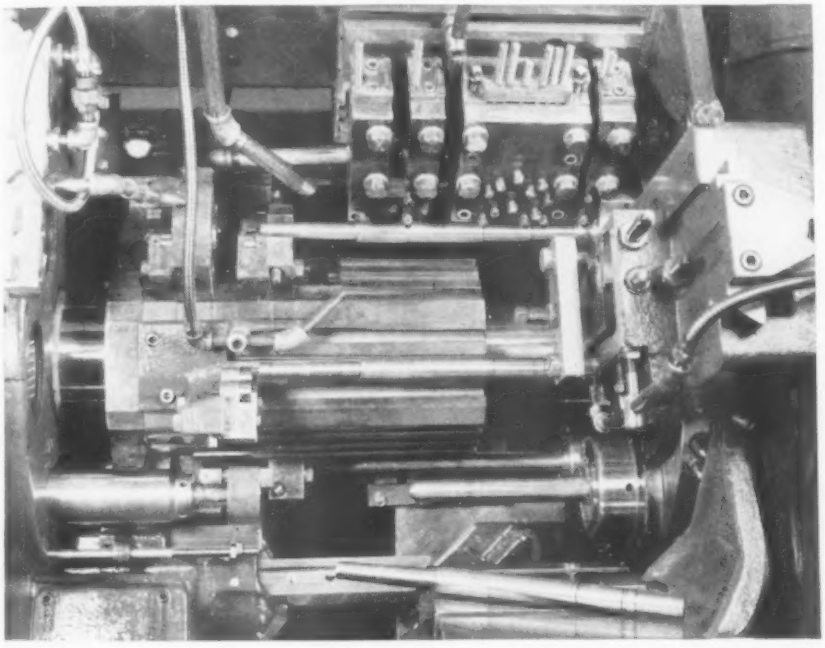
You can turn it on a one-purpose shaft machine—or on an Acme-Gridley Bar Automatic.

On either machine, you can produce a variety of shaft designs and dimensions, as the sketch indicates.

But when you consider machine tool investment, remember that the Acme-Gridley Automatic is a universal machine. It can turn out thousands of other parts, with equal precision, speed and low cost.

You can make big cost reductions through the broad adaptability of Acme-Gridley Automatics to jobs of almost infinite variety—through their flexibility of tooling for combination operations.

When you retool for new production, why not draw upon our broad experience with both Bar and Chucking Automatics? Write us—any time.



A single set of tools on this Acme-Gridley Bar Automatic can be adjusted to produce an infinite variety of shaft work, as suggested by the sketch above.

The NATIONAL ACME CO.

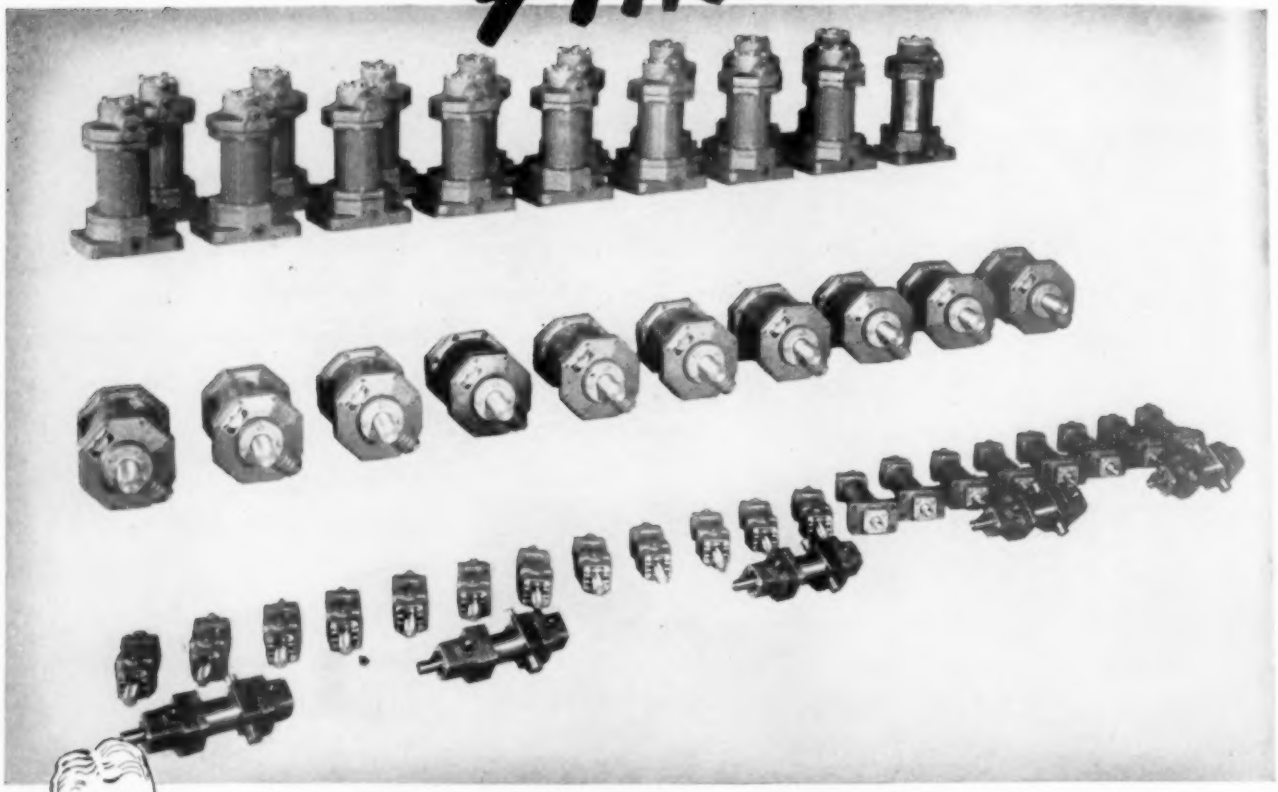
170 EAST 131st STREET • CLEVELAND 8, OHIO

COLLETS AND PUSHERS

The design, materials and methods of processing GENUINE Acme-Gridley Collets and Pushers are vital to continuous low-cost performance on your Multiple Spindle Automatics.

Bulletin CP-45

THESE GEROTOR AIR CYLINDERS



—ARE ALL GOING TO ONE CUSTOMER*

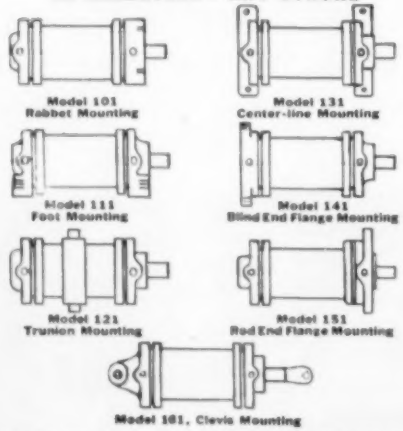
You, too, can profitably standardize on

GEROTOR AIR CYLINDERS

*Name on request.

7 STANDARD MOUNTINGS

12 DIAMETERS — ANY STROKE



- Compact design
- Self-sealing packings
- Rust resistant
- Any length cushioning available
- No tie rods
- Designed for 150# air and 300# oil and water service
- Large pipe connections rotatable to any position.

GEROTOR MAY CORP.

PLANTS—BALTIMORE, MD., LOGANSPORT, IND.

LOGANSPORT, INDIANA

SEND FOR CATALOG

They travel
HALFWAY AROUND THE GLOBE
to attend this "school"!

When the urgent call for defense—then war—production sounded throughout the nation, industry faced the huge task of swiftly training millions of "green" workers from all walks of life.

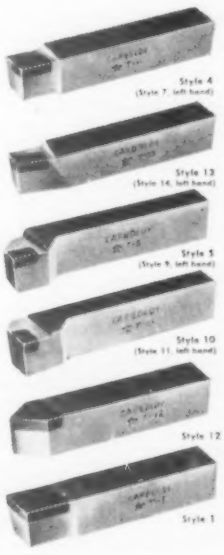
Carboloy Company—to fulfill its part in this tremendous undertaking—quickly expanded its long-established facilities for basic training—in fundamentals of carbide tool use and maintenance; immediately enlarged its training course quarters at Detroit.

Since Pearl Harbor, industry and government have sent to this "school" supervisory personnel from 38 states and many Allied countries—including even far-off Australia—halfway round the globe! Each man receives six days of intensive training covering actual shop work, practical "lecture" sessions, and discussion-reviews of Carboloy Training Films. He returns equipped to quickly pass this training along to supervisors and operators in his own plant. By this procedure, more than 2500 key men in plants engaged in vital war work have been prepared to meet their carbide training needs swiftly and efficiently.

So valuable is this Training Course in effecting reduced machining costs and increased production through a proven method of centralized control on carbide use in each plant, that for years it has been a permanent part of Carboloy service. Plants reconverting to civilian manufacture are invited to enroll their key supervisors in this free course. It was a proven aid to war production—and will be sound preparation for the highly competitive postwar era.

Send for descriptive booklet—GT-155.

Effective training in carbide use, plus availability of low cost standard Carboloy Tools such as these, has played a vital role in war—and will help plants prepare for the competitive postwar era.



CARBOLOY COMPANY, INC.

11124 East Eight Mile Boulevard

Sole makers of Carboloy Cemented Carbides

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PHILADELPHIA • PITTSBURGH • THOMASTON

Carboloy Products are also sold by leading Mill Supply Distributors

Booklet on Request

CARBOLOY

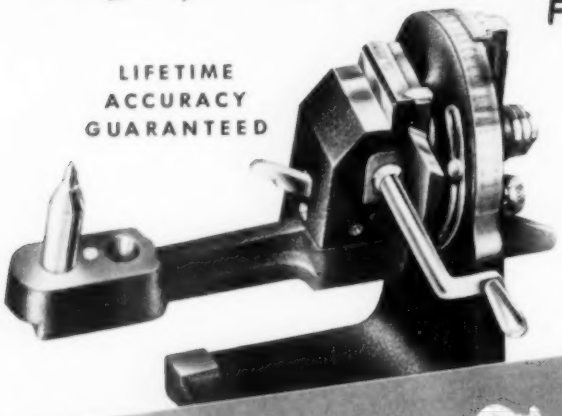
(TRADE MARK) CEMENTED CARBIDES

Service

Bley CONTOUR DRESSER

FOR SHAPING GRINDING WHEELS

LIFETIME ACCURACY GUARANTEED



FOR ABSOLUTE PRECISION IN THE FORMING OF GRINDING WHEELS: ANGLES, RADII AND THEIR COMBINATIONS AND PERFECT BLENDING OF RADII WITH TANGENTS . . .

TYPICAL FORMS MADE ON A SURFACE GRINDER, WITH BLEY CONTOUR DRESSER WITH ARROWED LINES SHOWING EXTENT OF CONTINUOUS TRAVEL WITHOUT A CHANGE OF SET-UP.

Operates on a totally new and different principle! . . . Guarantees absolute precision and accuracy throughout the life of the fixture! Priced to meet the needs of the small shop—and priced so that purchase of several is practical for the larger shop.

1 Precision is guaranteed for the life of the fixture. Guaranteed accuracy of repeated redressing of grinding wheels at a tolerance of less than .0005"

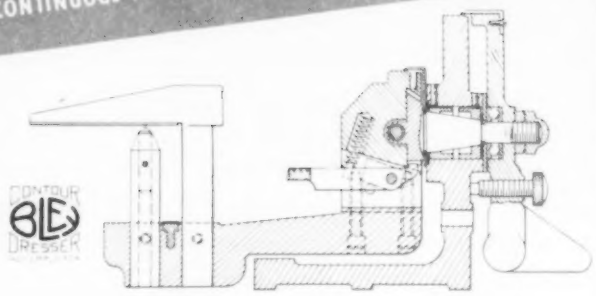
2 Even the most complicated "setup" can be made right on the bench.

Capacity: grinding wheels up to 14" in diameter. (A special arm extending capacity to 24" diameter is available.) 3" male and 3" female radii. Total of 2" lineal travel for angular work. Tangents: 1" on either side of radius.

Est. 1925

GOLCONDA DIAMOND PRODUCTS CORP.

3420 NORTH KNOX AVENUE • CHICAGO 41, ILLINOIS



BLEY CONTOUR DRESSER

WITH 9 DIAMOND TOOLS

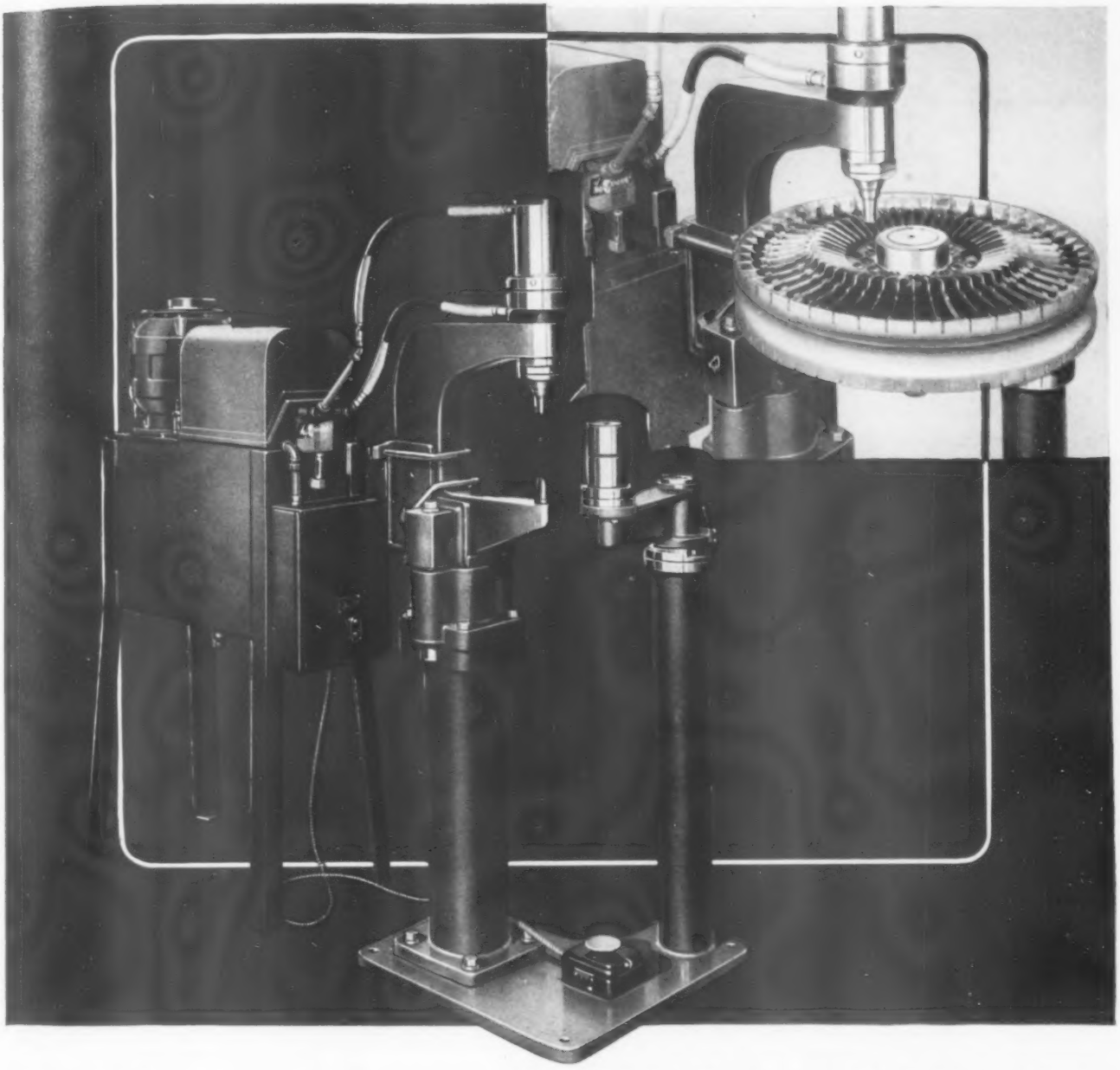
90° GOLCONE shaped point	$ 3.50
60° GOLCONE shaped point	4.00
CRYSTAL point	3.50
ELONGATED natural point	5.00
Rattail Tools For Semi-Circular Radii	
1/2" Rattail, radii from 0.250"	$ 7.50
1/4" Rattail, radii from 0.125"	7.50
1/8" Rattail, radii from 0.060"	5.00
3/32" Rattail, radii from 0.040"	7.25
1/16" Rattail, radii from 0.030"	8.50
	$51.75

6 EXTENSION SLEEVES and 1 RATTAIL TOOL ATTACHMENT

ALL FITTED IN FINE HINGED WOOD INSTRUMENT CASE

PRICED COMPLETE

$207.50



Another example of "Hy-Power" Riveting

This "Hy-Power" hydraulic riveter is an adaptation of a 17½ ton unit to meet the needs of production riveting of Runner Assemblies for the hydraulic couplings made by Twin Disc Clutch Company.

The "Hy-Power" yoke has 10 inch reach and 4 inch stroke, giving clearance for handling the assembly. Two rows of ⅜ in. rivets are applied in the center of one row of ¼ in. rivets at the outer edge of the runner. The simple swinging fixture allows easy handling and is adjustable for different rivet circles. Rivets are inserted from above and headed on the under side.

The exclusive "Hy-Power" hydraulic operation combines fast, easy handling and tight, uniform rivet application. The automatic operating cycle is push-button controlled. Hannifin "Hy-Power" equipment meets today's needs for fast production, uniform quality of work, and continuous duty. In addition to production riveting, "Hy-Power" units are being used for punching, press-fit assembly, and other work involving the application of pressure. Write for Bulletin 53 with complete data.

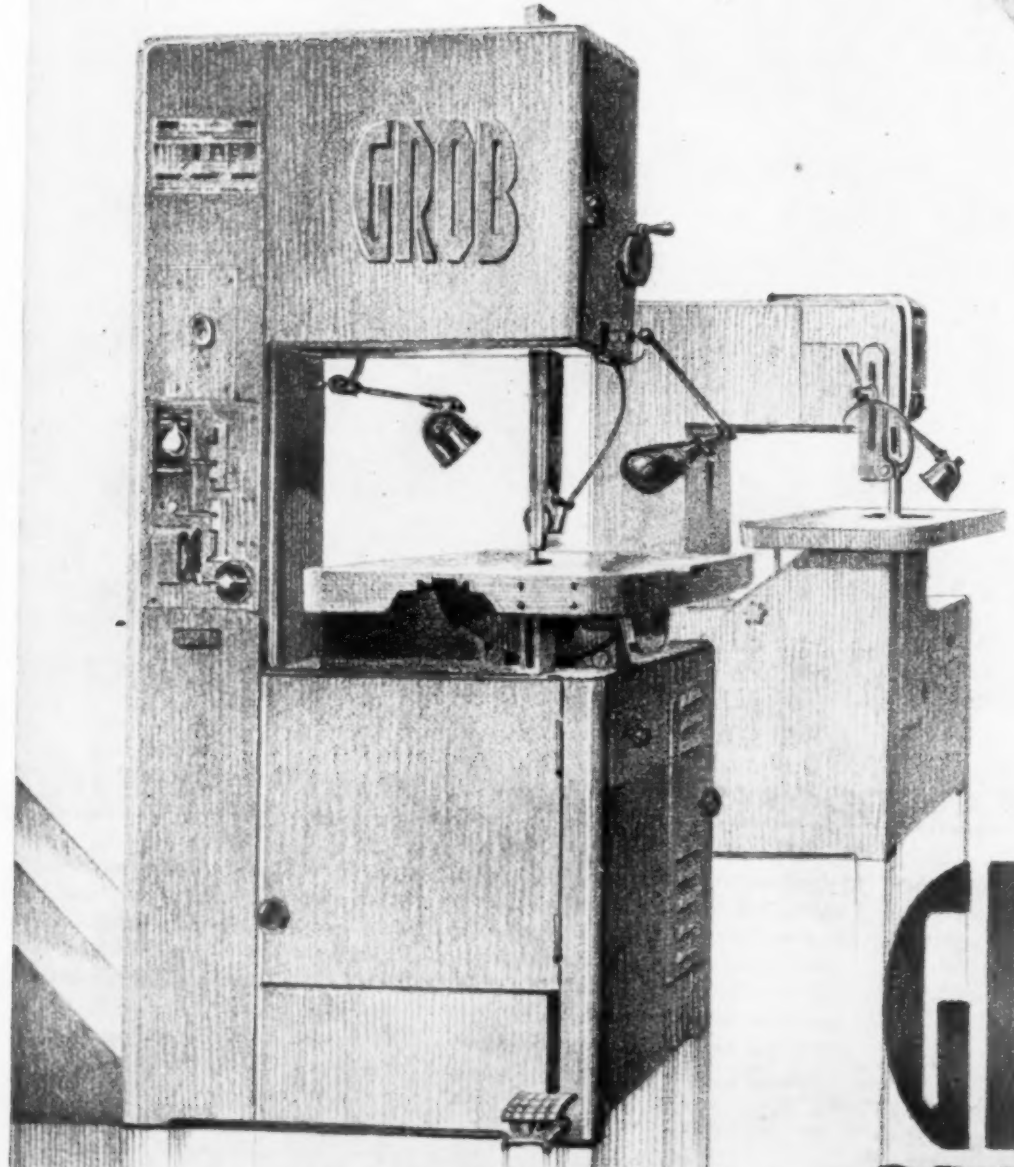
Hannifin Manufacturing Company, 621-631 South Kolmar Avenue, • Chicago 24, Illinois.

HANNIFIN · CHICAGO · USA

Hannifin

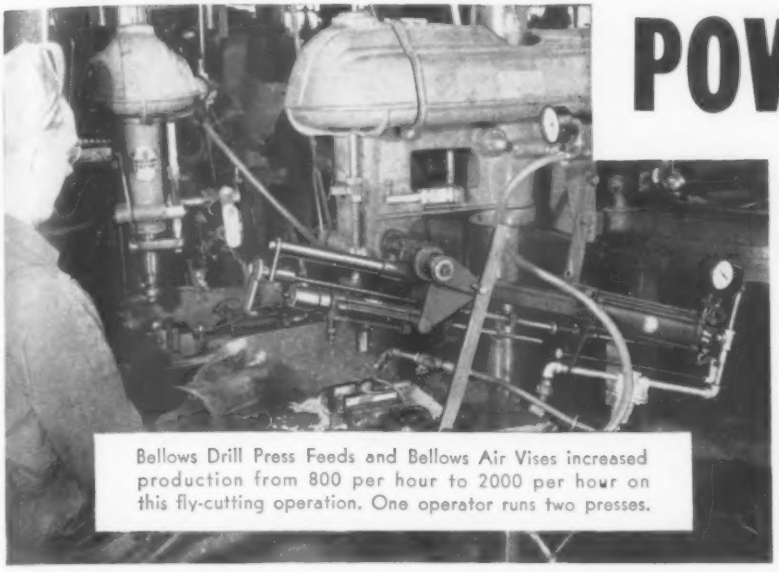
"Hy-Power" RIVETERS PUNCHES PRESSES

SAWING FILING



GROB
BROTHERS
GRAFTON WISCONSIN

DOUBLE MAN-POWER OUTPUT
with Bellows-Senacon Controlled-Air



Bellows Drill Press Feeds and Bellows Air Vises increased production from 800 per hour to 2000 per hour on this fly-cutting operation. One operator runs two presses.

POWER FEEDS

Eliminate Hand Feeding of Drill Presses, Milling Machines, Grinders, etc.

●

Make Your Hand-Fed Equipment the Equal of High-Priced, Hard-to-get Special Machines.

YOU can boost production (as much as 50% to 500%) by converting your standard machines to fast, automatic units, with Bellows-Senacon Controlled-Air-Power Feeds.

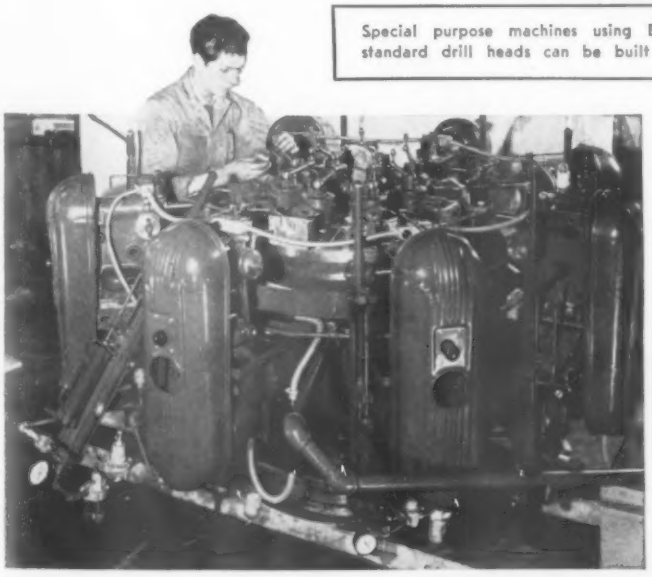
At a touch of the handle, these sensitive Bellows-Senacon feeds advance the work or tool a pre-determined distance, under a pre-determined power thrust, and at a perfectly controlled rate of feed. This unlimited variation of feeding rate (not a series of "step" adjustments) makes it easy to pick just the right feed for stock or tool. Neither too fast, nor too slow. Just right.

Air-driven for speed, and for flexibility in use, hydraulically checked for utmost smoothness without chatter, backlash, or jump, these quickly installed Bellows-Senacon Feeds mean not only greater production, but better production. Idle travel time is reduced, tools stay sharp longer, closer tolerances can be maintained.

And employees like them — for the elimination of repetitive manual operations means less worker fatigue, fewer shop accidents.

Investigate quickly this inexpensive way to boost man-hour output and lower production costs. Strengthen your position in the coming competitive market!

Special purpose machines using Bellows-Senacon Feeds with standard drill heads can be built quickly and inexpensively.



Write today for the new, free, Photo Facts File showing typical installations where Bellows-Senacon equipment increased production 50% to 500%!

The Bellows Co.

SENACON DIVISION

861 E. Tallmadge Avenue • Akron 10, Ohio

An advertisement without a headline may be unusual but so is the skill of our many craftsmen. Consistent with the steady pace and efficiency which these people attain every day, we will not interrupt the story with two or three words that may detract. Their pride goes into the manufacture of precision parts or the production of special machinery, tools, dies, jigs and fixtures. The products deserve the headlines. Many examples of their fine craftsmanship are spelling success in numerous industries that have served the Allied Nations both for war and peace.

Olofsson

TOOL AND DIE COMPANY
LANSING 2, MICHIGAN

CHICAGO ENGINEERING OFFICE—600 SOUTH MICHIGAN AVENUE

GORTON

SPECIALISTS FOR OVER 50 YEARS IN

Tracer-Controlled MILLING

8 mm. movie camera case profiled in large quantities

TRACER CONTROL Proven FASTER METHOD FOR HIGH PRODUCTION PROFILING

High Accuracy and Finer Finish Maintained . . . Production Doubled

An American camera manufacturer found the Gorton Duplicator the ideal machine for high production profiling of both seat for cover and film tract clearance of camera cases, holding tolerances of ±.003″. Gorton high spindle speeds produced the required fine finish.

SIMPLE HEAT-TREATED MASTER determines cutter path. For high production, pneumatic clamping provides easy loading and unloading and simultaneously regulates flow of coolant.

On jobs like this, the Gorton Duplicator permits any reasonably good operator to perform satisfactory work, maintaining high accuracy, comparable to results of highly skilled mechanics on special production equipment.

PRODUCTION DATA

Operation—Profiling to fine finish.
Material—Aluminum alloy.
Speed—4,000 r.p.m.
Feed—Manual.
Production—30 per hour.
Previous Method—15 per hour.

GORTON ENGINEERING SERVICE, FREE

Investigate the possibilities of the Gorton Duplicator as the practical, economical solution to your high production profiling problems. Gorton engineers who have specialized for 50 years in the development of tracer-controlled milling will give you their recommendations without obligation. Submit part, prints or specifications to your Gorton dealer, or Factory at Racine, Wis.

The Right S… The Right T… of Machin… for Every Job

From 2 oz. to 2…

DIE BLOCKS

Tracer-Controll… MILLING

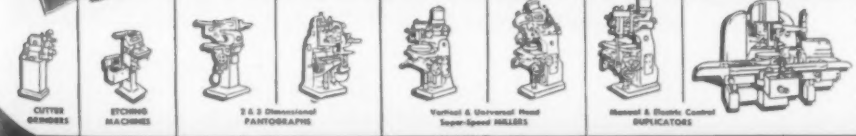
Tracer-Controll… DUPLICATING

Tracer-Controll… ENGRAVING

Tracer-Controll… ETCHING

GORTON ARMY-NAVY

GORTON *Precision* MACHINES


CUTTER GRINDERS
ETCHING MACHINES
2 & 3 Dimensional PANTOGRAPHS
Vertical & Universal Head Super-Speed MILLERS
Manual & Electric Control DUPLICATORS

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Company.....

Address.....

City..... *State*.....

Hammond of KALAMAZOO

6" ABRASIVE BELT GRINDER

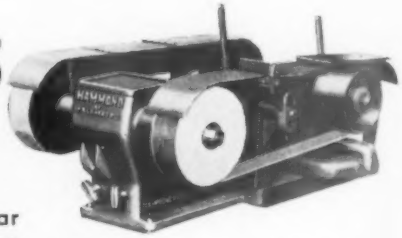
For wide variety of finishing operations on all types of materials. Operates Wet or Dry in Vertical or Horizontal position. Other machines up to 10" width belts.

ABRASIVE BELT and CARBIDE TOOL GRINDERS

F2 FLEXIBLE BELT GRINDER

One of our most popular machines especially suited for irregular shaped parts. Eliminates many costly hand filing operations.

NO. 5 GRINDER POLISHER



Another popular high production grinding, polishing, buffing, deburring and brushing machine — uses either abrasive belts or wheels, as desired, for the finishing operation to be performed.

CB-76 HEAVY DUTY

CHIP BREAKER and CUP WHEEL GRINDER
V-BELT DRIVEN

Heavy, rugged, durable machine for large volume grinding of carbide tipped tools. Handles all types of box and single point tools up to 2" (larger if required).

W-10

10" WET GRINDER
V-BELT DRIVE

Hammond offers a complete line of roughing and finishing machines. 6", 10" and 14" cup wheel grinders provide fast efficient carbide tool maintenance. Wet Grinders feature No Spray—No Splash Guards and Safety Cup Discs.

HAMMOND PRODUCTS CARBIDE, GENERAL PURPOSE AND ABRASIVE BELT GRINDERS AUTOMATIC AND CYLINDRICAL FINISHERS • POLISHING LATHES

Hammond Machinery Builders INC.

1661 DOUGLAS AVE. KALAMAZOO 54, MICHIGAN • EASTERN BRANCH: 71 WEST 23rd ST., NEW YORK 10, N. Y.

CHICAGO CUT-OFF WHEELS

From the swift era of war production comes another modern miracle, the cut-off wheel—man power and man hour saver—for the fastest, smoothest method of cutting tubing, wire, steel and brass sheets, glass, porcelain, Stellite, tungsten, plastics, laminates and other hard-to-slice materials.

When RT, the special formula bond was developed, it put the cool-running CHICAGOS 'way out in front in real performance records.

Available in rubber or resinoid—a full range of styles and sizes. 3 bond types—for every operation

WANT TO TRY ONE? Tell us what you have to cut, grinder you use and size wheel you'd like. We'll send a test wheel promptly. *Write for Circular.*

CHICAGO WHEEL & MFG. CO.

Originators of the famous Chicago Soft Rubber Polishing Wheels

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MADE WITH RT

THE NEW BOND THAT HOLDS ITS OWN . . . GIVES ONLY WHEN IT MUST!

Send CIRCULAR____ SEND TEST WHEEL____ SIZE____ TO CUT____

NAME_____

ADDRESS_____

CITY_____ STATE_____

SO MANY JOBS WITH THIS ONE STEEL

BTR TOOL STEEL

WHAT IT IS: Bethlehem Tool Room (BTR) is *the* standard general-purpose, oil-hardening tool steel of the industry.

WHAT IT HAS: A carbon-chrome-tungsten-vanadium combination that assures safe hardening . . . durable cutting edge . . . deep hardening . . . low distortion and small dimensional changes.

WHY IT'S EASY TO HANDLE: Annealed for easy machining.

Has uniform analysis and hardenability.

Simple to heat-treat.

Does not decarburize readily.

TYPICAL USES: For dies employed in the shaping, forming, blanking, punching, and shearing of both ferrous and non-ferrous materials.

For master hobs, broaches, drill bushings, knurling tools, gages, taps, and many other commonly used tools and parts.

If you're looking for *one* steel that will do *many* types of jobs, stock BTR in your tool room. It's a multi-purpose steel; you'll be amazed at its versatility. Pleased, too, at the money it saves you, both directly and indirectly. Pick up the telephone and ask your distributor for BTR.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Bethlehem Steel Export Corporation, New York City

BETHLEHEM TOOL ROOM... one of Bethlehem's *Big 8* Tool Steels

Announcing the New

MODEL C Milwaukee

AUTOMETRIC BORING MACHINE

Advanced in every detail the Model C Autometric Boring Machine offers initial high accuracy — design and construction to sustain this initial high accuracy through out a long productive life — unexcelled simplicity, ease and convenience of operation.

Note these "shop-tested" features:

- Column, bed and chip guard cast in one sturdy unit — integral design.
- Rugged, compact, balanced construction with exceptionally low center of gravity — minimum vibration.
- Hardened, ground, and lapped quill, saddle and table ways — for sustained accuracy.
- Large diameter quill with extra long bearing, sliding in a fixed headstock, provides the total range of vertical movement — fewer moving parts.
- Direct measuring by Precision Screw Locating results in faster operation—with no loose pieces to handle
- Rapid traverse to spindle quill is instantly available — speed and ease of operation.
- Greater Speed and Feed Range — infinitely adjustable spindle speeds from 50 to 2500 rpm; 8 boring feeds .0005" to .0148" per revolution of spindle.

Your precision boring costs can be reduced — g
complete information on the Model C Milwaul
Autometric — write for Catalog No. CMA10.

KEARNEY & TRECKER

Products

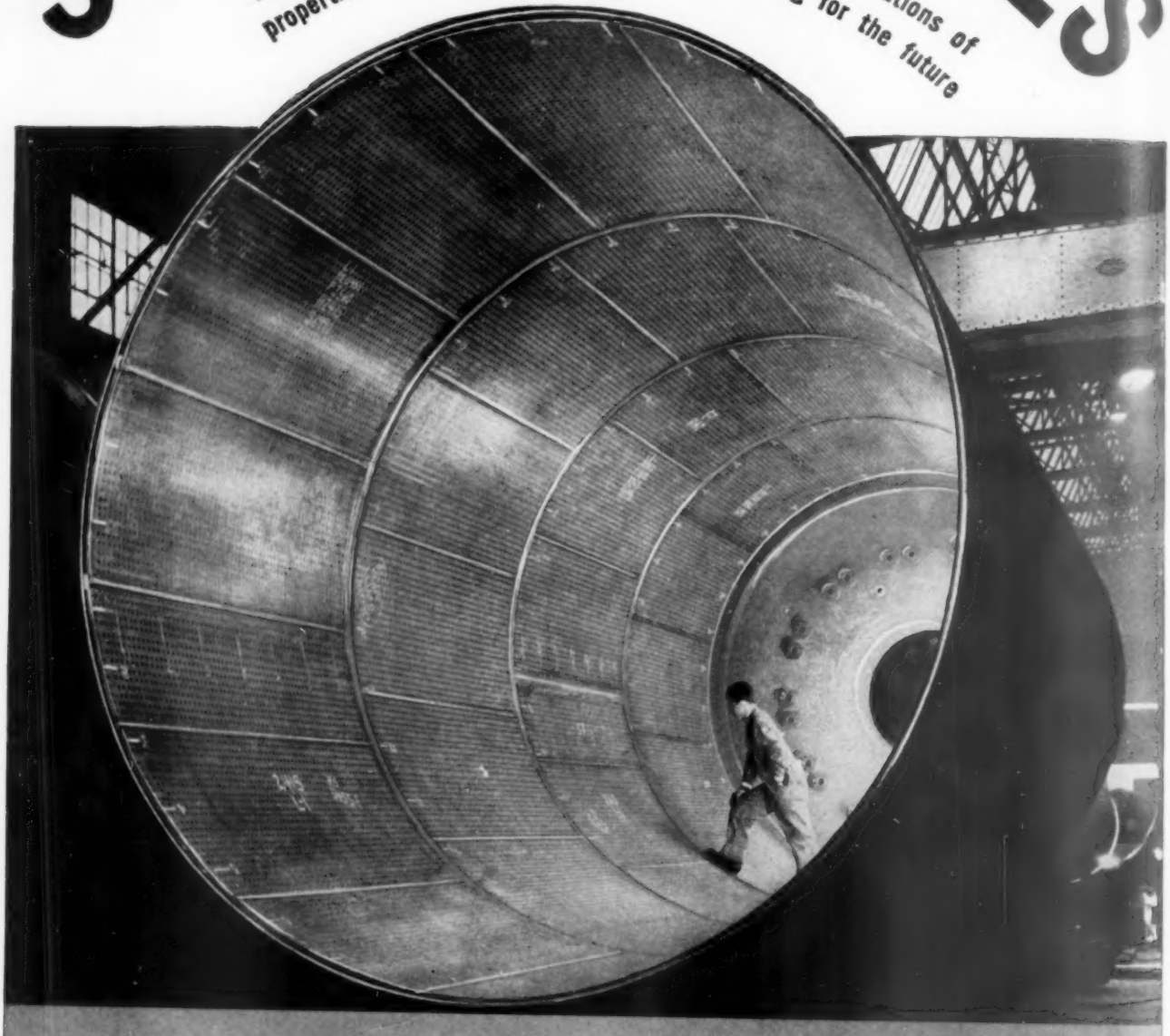
CORPORATION **WISCONSIN**

Subsidiary of Kearney & Trecker Corporation

WAUKEE 14,

STAINLESS STEELS

Most versatile of modern metals... their unique combinations of properties merit your consideration in designing for the future



The commonly used chromium-Nickel type stainless steel that lines this fractionating column possesses natural immunity to rust and corrosion under virtually all oxidizing-acid conditions. Its resistance to creep, scale or oxidation at high temperatures assures long economical operation. Built by A. O. Smith Corporation, Milwaukee, this column, including the top section, exceeds 125′ in length.

* * *

International Nickel are miners, smelters and refiners of Nickel, an important ingredient of the stainless steels, but do not produce stainless steels. If interested, please communicate with established sources of supply for stainless steels.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N. Y.

EASTERN CUTTER

HIGH SPEED TOOLS

RECUT OR CONVERTED

Never
Consider a Tool Scrap Until You Consult Us First

NEW CATALOG NOW READY

EASTERN CUTTER
CORPORATION
30-32 LITTLETON AVE. NEWARK 7, NEW JERSEY

IF YOUR GRINDING PROBLEM IS

Small Pieces — **At High Production** — **To Close Tolerances**

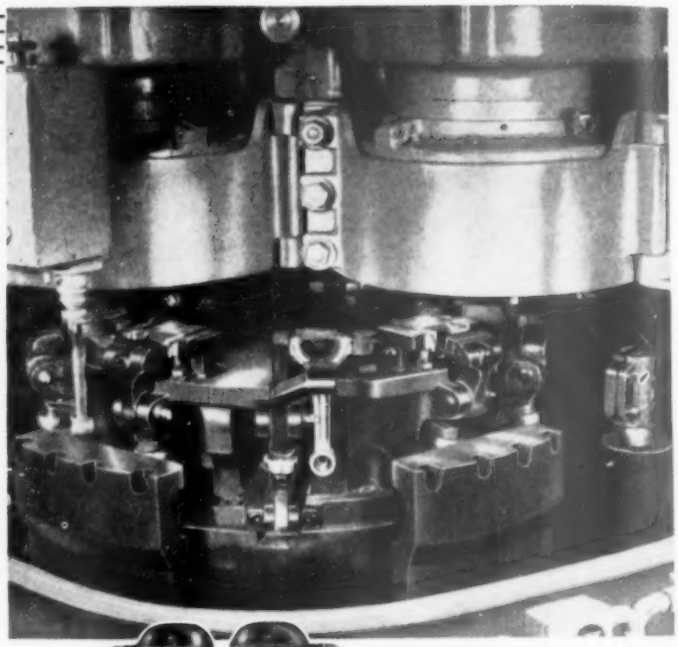
use the HANCHETT 24-A2 . . .

ALL IN ONE PASS!

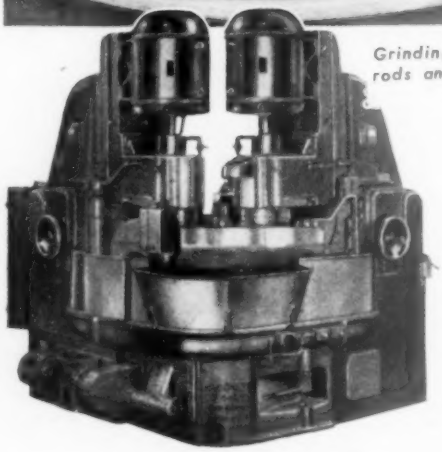
In one pass, pieces are rough and finished ground, as well as automatically sized after passing each grinding wheel. Tolerances of + or − .0005 are easily maintained on continuous production runs at a savings over other finishing methods of as much as 500% and more.

The duplex head construction of the new Hanchett 24-A2 Automatic Rotary Surface Grinder raises the "small-piece finishing job" to higher production levels than ever before obtained.

Don't let matching operations boost your production costs out of line. Hanchett engineers will be glad to study your problem and offer constructive assistance.



Grinding automotive connecting rods and caps in one pass with one fixture set-up.



Hanchett 24-2A Automatic

For further details See your nearest Hanchett Dealer or Write for Bulletin

144-TTE

IF IT'S A FLAT SURFACE—THERE'S A HANCHETT TO GRIND IT

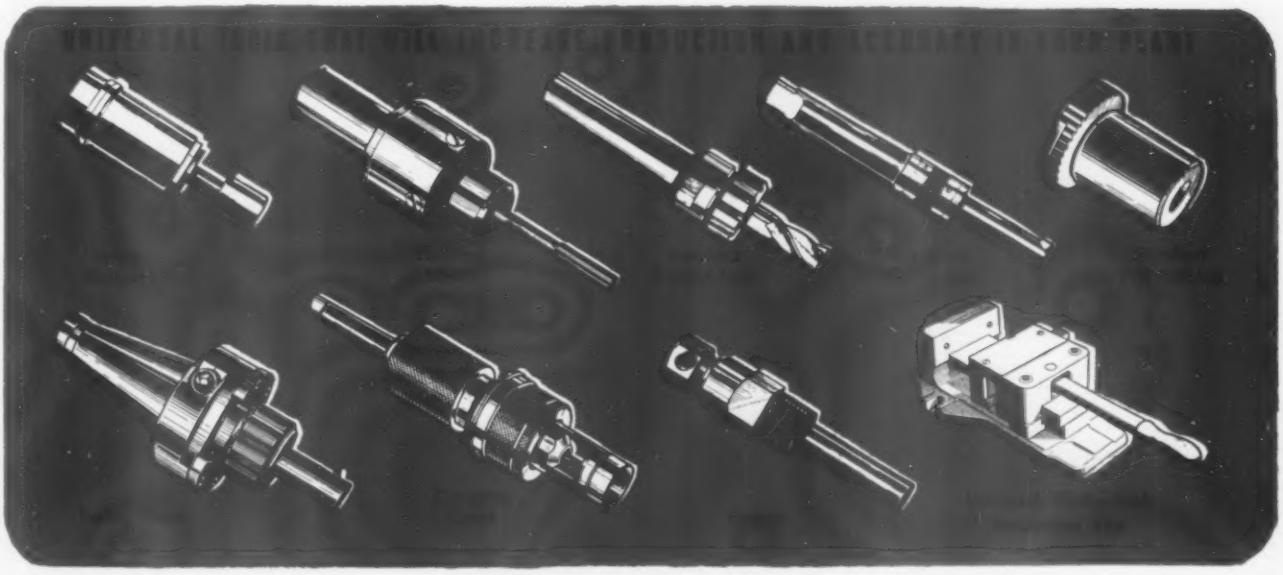
HANCHETT MANUFACTURING CO.
BIG RAPIDS, MICHIGAN U.S.A.

RSAL MIKRO-LOK BORING BARS—
PERFECT TOOLS FOR
UTS WITH
URACY

pe Precision
ing Tool

Because they are
mechanism which permi
tool to within .0001" accuracy,
lok Boring Bars may be used eff
and semi-finishing cuts as well as rou
ism, perfected by Universal Engineering Co., is a
micrometer-like dial. Thus, tool can be set easily and
effect a great savings in time and appreciable improvement in
accuracy. The special design of Universal Boring Bars makes them
adaptable to boring to a shoulder or to the bottom of a hole, or for taking
mittent cuts. Floating Blade Reamer Bar gives size control not obtainable with any
other tool. Write for complete information on how Universal Mikro-lok Boring Bars and
other superior Universal products illustrated here will speed accurate production in your plant.

Floating Blade
Reaming Bar



UNIVERSAL ENGINEERING COMPANY

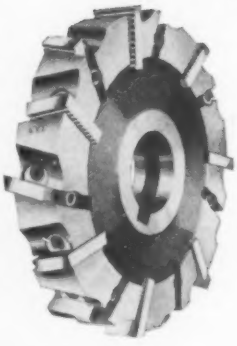
FRANKENMUTH, . MICHIGAN Fighter Plane Given by Employees 20% Employee Bond Deductions

McCROSKY Jack-Lock MILLING CUTTERS

TRADE MARK REG. U.S. PAT OFF.

High Speed, Cast Alloy or Carbide Tipped Blades

for Increased Production, Lower Costs



● You'll get more pieces per day, at lower cost per piece, and need fewer tools to keep a job in continuous production with Jack-Lock Milling Cutters. Originated, perfected, and available only from McCrosky, Jack-Lock Cutters hold the blades rigidly and solidly permitting safe operation at higher feeds and speeds. Easy release of the blades—without hammering—and speedy, uniform adjustment,—permit regrinding with minimum loss of stock,—a particular advantage when carbide tips are used.

Specify Jack-Lock face mills, shell-end, half-side, and staggered tooth cutters for your plant,—and get all the design and operating advantages only Jack-Lock Cutters can give you.

McCROSKY TOOL CORPORATION
MEADVILLE, PA.

COST CUTTING TOOLS

Designers and Manufacturers of

Jack-Lock MILLING CUTTERS

Block Type BORING BARS

Wizard CHUCKS AND COLLETS

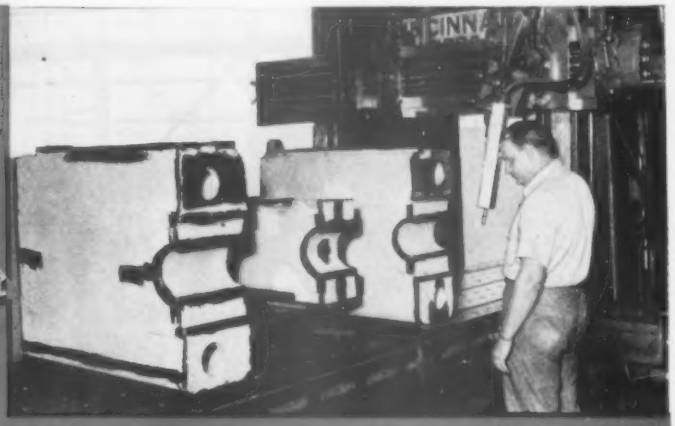
Super Adjustable REAMERS

Turret TOOL POSTS

MODERN PRECISION WELDMENTS FOR "HEAVY STUFF"!

Modern large-scale precision weldments, made possible by advanced techniques developed during the war, are already proving highly advantageous in the heavy machinery industries. Special weldments, designed, fabricated and finished at Warren City, are replacing steel castings in many important applications. In the Bliss Enclosed Press shown here, the crowns, beds and slides are now Warren City weldments, saving weight and increasing strength. High precision is assured by accurate normalizing, stress relieving, machining and testing, with the finest and most modern scientific methods and equipment.

Finishing a precision-tested Bliss press crown, fabricated from welded steel plates at Warren City



WELDMENTS SAVE WEIGHT, ADD STRENGTH, IN FAMOUS BLISS INDUSTRIAL PRESSES

Eliminate Pattern Costs and Casting Defects!

IF YOUR PROBLEM involves the use of heavy steel castings or weldments, be sure you don't overlook the unusual production facilities and know-how available to you at Warren City Manufacturing Company. Located in the heart of the Cleveland-Pittsburgh industrial area, our huge seven-million-dollar plant contains every modern device for handling, cutting, fabricating, welding, normalizing, machining, assembling and testing heavy steel machinery, parts and equipment. Whether, as in the case of the E. W. Bliss Company, your situation may call for redesigning your present steel castings to enjoy the many advantages of modern precision weldments, or whether your need is simply for extra production capacity without increasing the size of your plant, our engineering staff will be glad to offer you their recommendations without obligation. Write today for our illustrated brochure, including a complete listing of our modern and extensive facilities.

WARREN CITY MANUFACTURING COMPANY ★★★

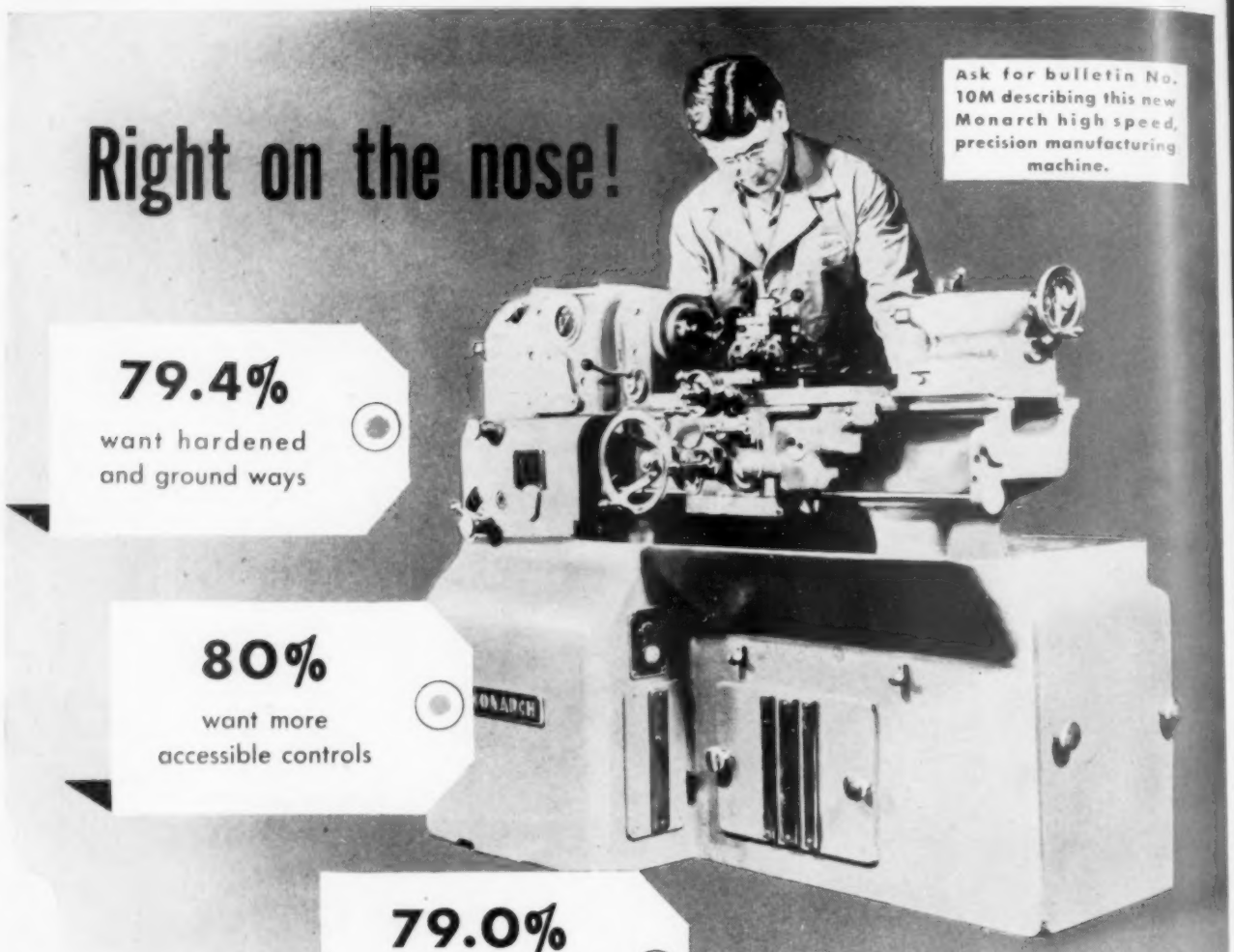
DEPARTMENT H

WARREN, OHIO

Wholly Owned Subsidiary of
GRAHAM-PAIGE MOTORS CORPORATION

Right on the nose!

Ask for bulletin No. 10M describing this new Monarch high speed, precision manufacturing machine.



79.4% want hardened and ground ways

80% want more accessible controls

79.0% want to use carbide tools

60.6% want reduced vibration

These four major requirements of machine tool users were revealed in the survey made by the magazine "STEEL". Monarch turning machines hit them right on the nose, because these four, as well as many other expressed preferences, were already incorporated in the new and improved Monarch line.

This is evidence of the far-sighted, pioneer thinking of Monarch engineers. Many times we have answered industry's call for faster, finer turning at lower cost. And many times, we have worked *ahead* of industry.

For the most modern turning machines, install Monarchs.

ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

THE MONARCH MACHINE TOOL COMPANY • SIDNEY, OHIO

FACTORY BRANCHES:

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801 Fisher Building Detroit 2, Mich.
10465 Carnegie Ave. Cleveland 6, Ohio
635 Industrial Office Bldg. Newark 2, N. J.
512 Empire Building Pittsburgh 22, Pa.
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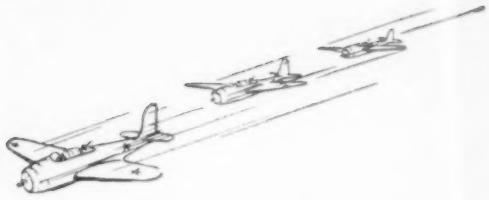
Representatives in Principal Cities

NORBIDE* POINTS *the way to*
Increasing Dial Indicator Gage Life 100 times

NORBIDE Tips for dial indicator gages are extremely wear-resistant, will not scratch and will not become charged with particles of metal. For NORBIDE (the trade-mark of Norton Boron Carbide) is the hardest material made by man — second only to the diamond in hardness. This explains the extraordinarily long life of NORBIDE plug, ring, snap and keyway gages and dial indicator gage points.

NORTON COMPANY - Worcester 6, Mass.

*Hardest Material Made by Man



PINPOINT REAMING

The patented Lempco Dual-Spiral Hi-Speed Steel Expansion Reamer is fast, accurate, and economical. It eliminates honing, and the costly wear on plug gauges caused by abrasive left by honing. It reams smoothly over keyways and split bushings. Extension pilots are available for alignment jobs.

SPECIAL REAMERS DESIGNED TO MEET YOUR NEEDS SEND BLUEPRINTS

2-WAY FLUTES . . .

spiral in opposite directions simultaneously, effecting a clean, shearing action that finish-reams holes mirror-smooth. Equally efficient on any machinable metal or fibrous plastic. Blade segments are removable and economically resharpened. Good delivery.

BOXED SETS

with dimensional range from .495" to 1.295". Covers needs of most die, tool and maintenance shops. Set No. JR pictured shipped complete with pilots in fitted hardwood chest. This set of 6 has an expansion range equal to 30 ordinary spiral reamers.

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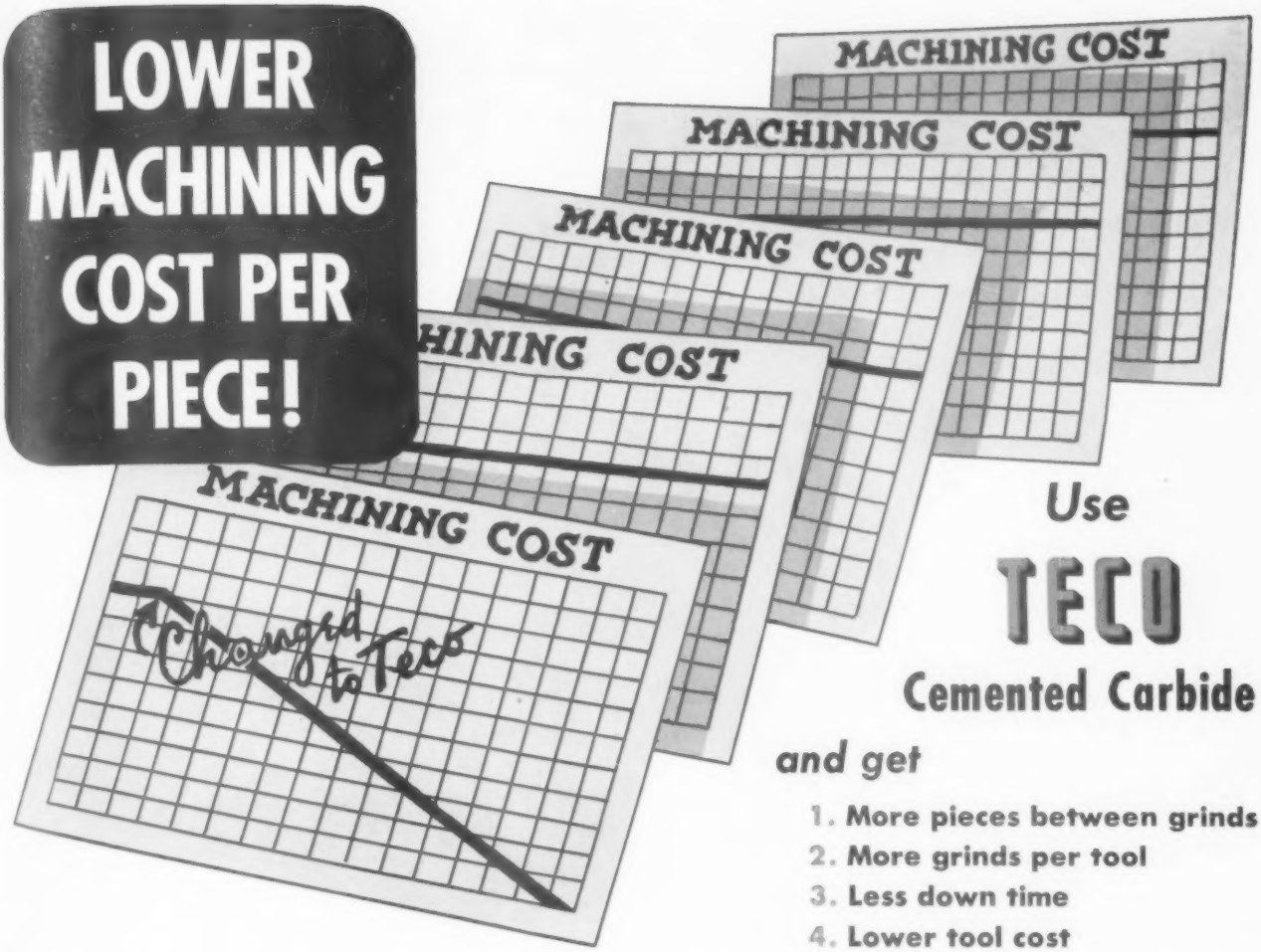
LEMPCO

5496 DUNHAM ROAD • BEDFORD, OHIO

LOWER MACHINING COST PER PIECE!



Use TECO Cemented Carbide

and get

1. **More pieces between grinds**
2. **More grinds per tool**
3. **Less down time**
4. **Lower tool cost**

TECO Cemented Carbide cuts **costs** as efficiently as it cuts **metals!** TECO produces more pieces per day—getting the most out of each machine-and-labor-dollar. TECO holds a keen cutting edge longer—reducing unproductive down time. TECO remains highly productive for the full life of the tool—lowering your tool costs.

Credit maximum resistance to wear and breakage for this remarkable cost-cutting performance . . . achieved by combining the correct qualities of hardness, toughness and uniformity in every piece of TECO Cemented Carbide.

PROVE IT YOURSELF! Tool up a machine or two with TECO Cemented Carbide, in place of present carbide tools. Then check your output and costs against previous results. Discuss your needs with one of our tool engineers. Write for catalog and price list.

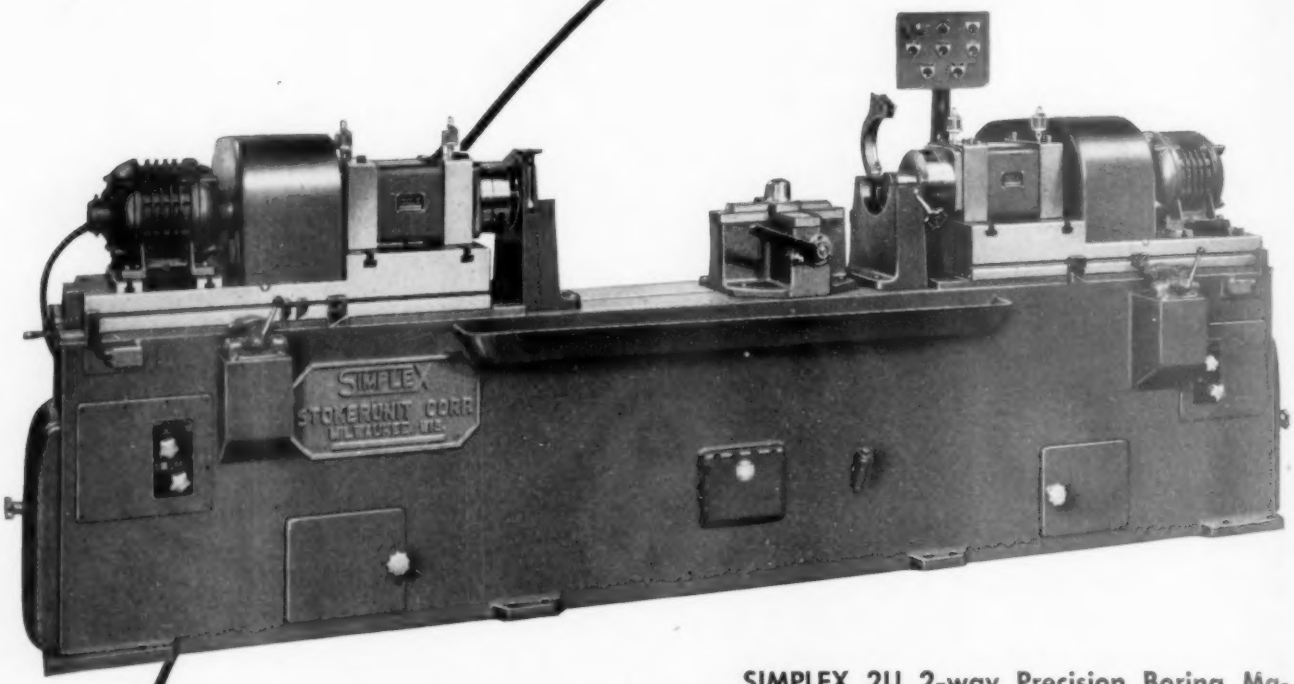
TUNGSTEN ELECTRIC CORPORATION
570 39th Street, Union City, N. J.

TECO
CEMENTED CARBIDE
Pioneers in Tungsten Carbides for over a Quarter Century

Branch Office: 2906 Euclid Avenue, Cleveland, Ohio
Representatives: Indianapolis, Ind., Chicago, Ill., Detroit, Mich.

SIMPLEX

A troublesome operation is the boring and turning of concentric cylindrical surfaces on bulky objects, rear axle housings, landing gear parts, etc. Equipment that will perform several operations at one setting of the work reduce these to their simplest form and provide low-cost production with high quality.



SIMPLEX 2U 2-way Precision Boring Machine with # 4 spindles and extended bed center section mounting a fixture designed to handle varying lengths of work units, resulted in high production rates for moderate quantities, greater convenience for the operator, and a uniformly high standard of quality.

Precision Boring Machines

STOKERUNIT CORPORATION

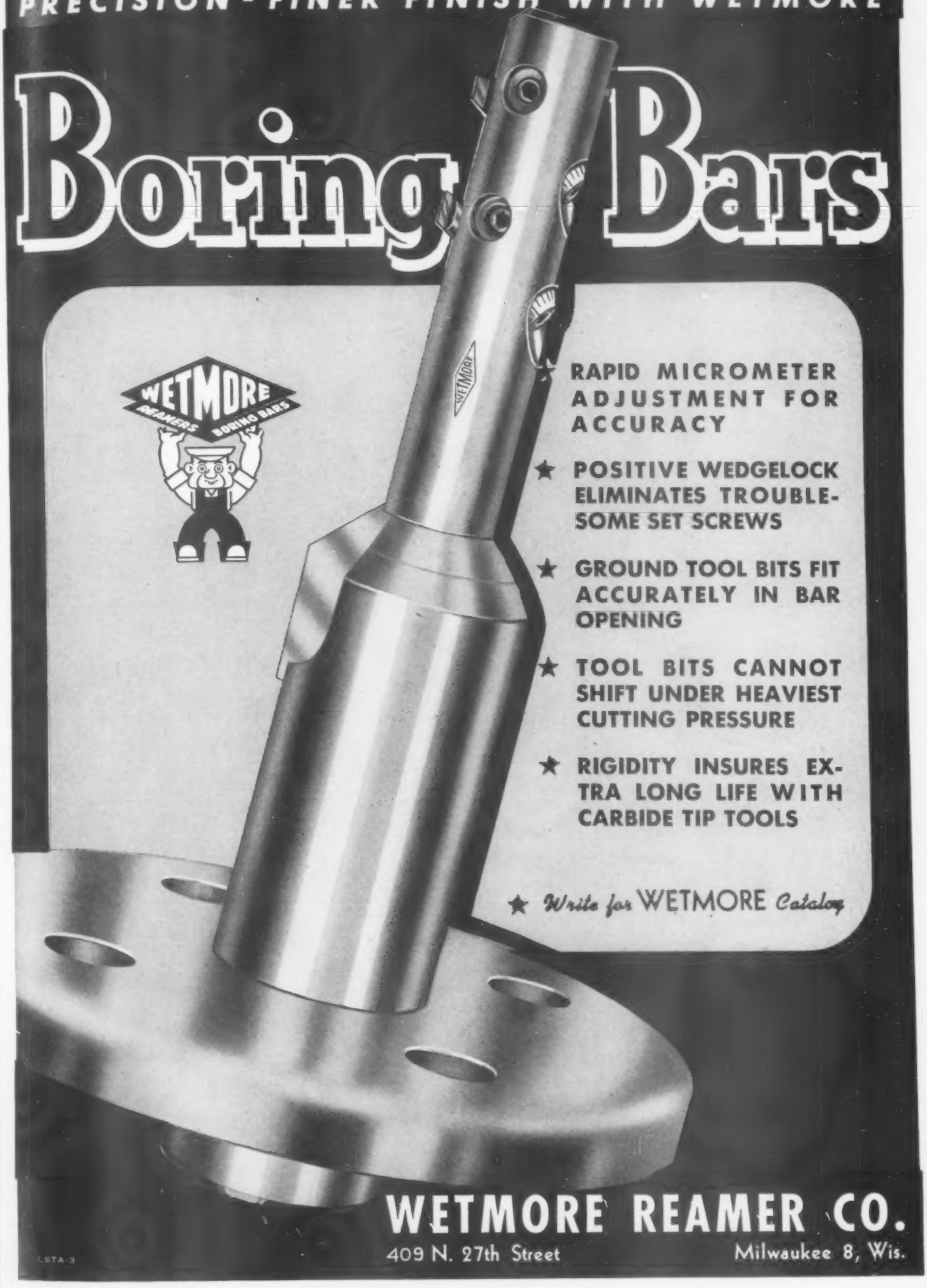
SIMPLEX Machine Tools Division

4528 West Mitchell Street, Milwaukee 14, Wisconsin

Precision Boring Machines, Planer Type Milling Machines and Special Machine Tools

PRECISION - FINER FINISH WITH WETMORE

Boring Bars



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★ POSITIVE WEDGELOCK ELIMINATES TROUBLE-SOME SET SCREWS

★ GROUND TOOL BITS FIT ACCURATELY IN BAR OPENING

★ TOOL BITS CANNOT SHIFT UNDER HEAVIEST CUTTING PRESSURE

★ RIGIDITY INSURES EXTRA LONG LIFE WITH CARBIDE TIP TOOLS

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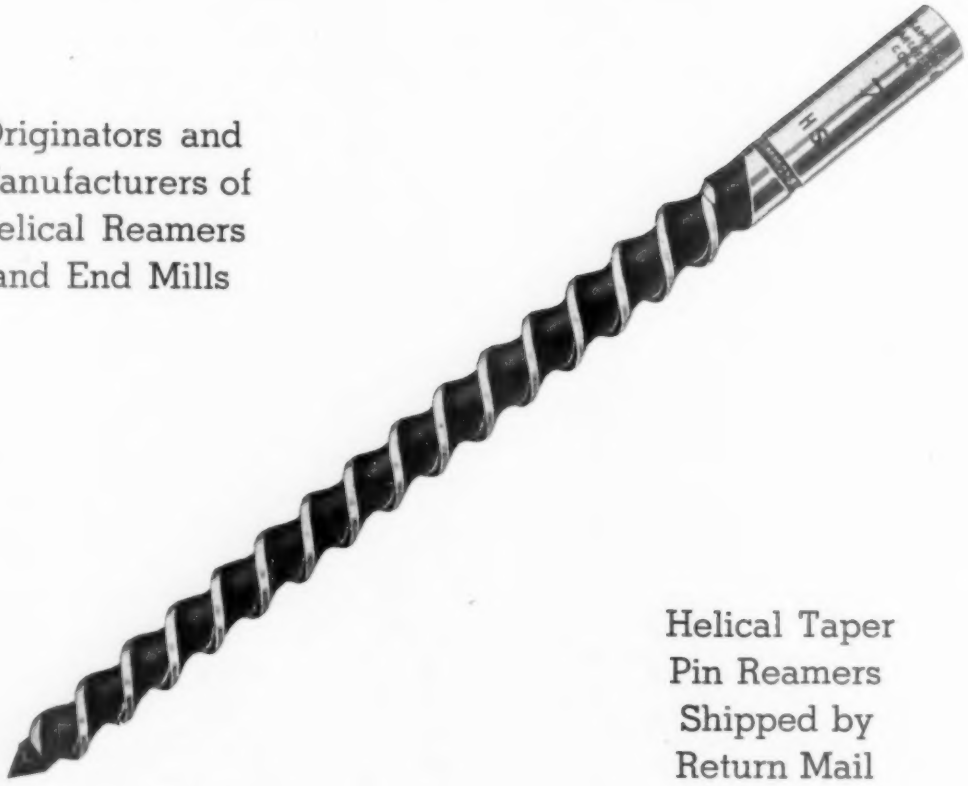
GAMMONS REAMERS ★

Originators and
Manufacturers of
Helical Reamers
and End Mills



Helical Taper
Pin Reamers
Shipped by
Return Mail

★ *The*
GAMMONS-HOAGLUND
Company

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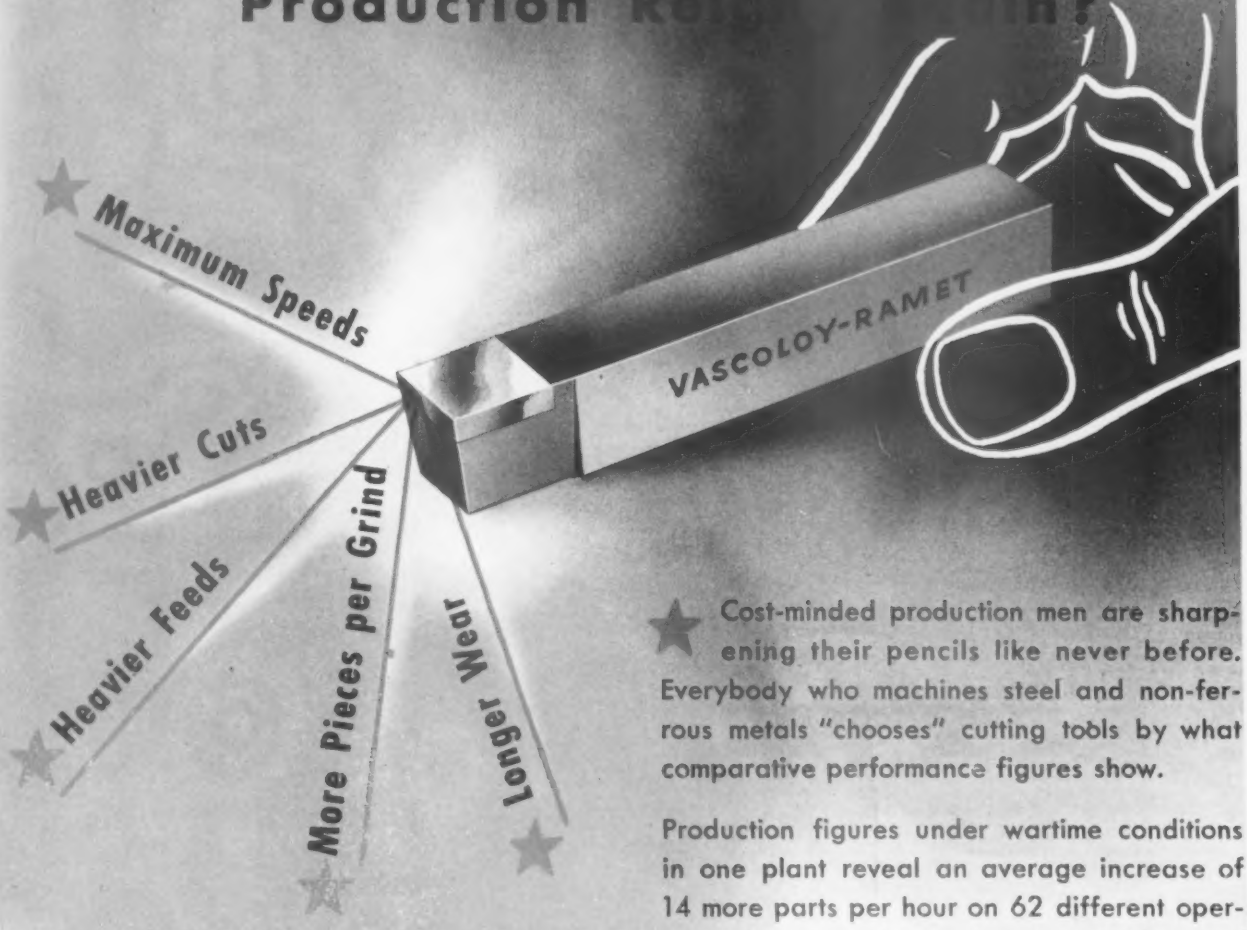
MANCHESTER, CONN.

HOW DO YOU DO-

..Now That Competitive Production Re[illegible]in?



Cost-minded production men are sharpening their pencils like never before. Everybody who machines steel and non-ferrous metals "chooses" cutting tools by what comparative performance figures show.

Production figures under wartime conditions in one plant reveal an average increase of 14 more parts per hour on 62 different operations by use of Vascoloy-Ramet Tantalum/Tungsten Carbide Tools.

Our field representatives are ready at all times to help you in the application of the "World's Finest Carbide Tools" on your lines. Write for your copy of Bulletin VR-350A.

FOR QUICKER SERVICE TO YOUR PLANT

Complete Stocks of VASCOLOY-RAMET STANDARD CARBIDE TOOLS and TANTUNG CAST ALLOY STANDARD CUTTING TOOLS are maintained for your convenience at:

DETROIT • NEW YORK
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VASCOLOY RAMET CORPORATION

AN AFFILIATE OF FANSTEEL METALLURGICAL CORPORATION AND VANADIUM-ALLOYS STEEL COMPANY

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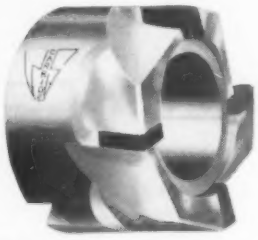
WENDT-SONIS

the most complete line of

STANDARD CARBIDE TIPPED CUTTING TOOLS

W-S STANDARD REAMER WITH CARBIDE TIPS . . .
Straight or tapered shanks. Sizes ¼" to 1½" diameter. Also Jobber, Right Hand Spiral and Left Hand Spiral Styles.



W-S CARBIDE TIPPED SHELL END MILLS . . .
Excellent long-life tool. Sizes from 1¼" to 6" in diameter. New design for machining steel.

W-S CARBIDE TIPPED LATHE CENTERS . . .
Styles for both turning and grinding. Concentricity guaranteed to within .0002". Morse, Brown & Sharpe and Jarno tapers.

The Wendt-Sonis line is complete . . . you will find it to contain a wide range of standard sizes and types. The Wendt-Sonis line is standard . . . this means uniform quality . . . rapid service from complete distributor and factory stocks.

Wendt-Sonis produces cemented, carbide tipped cutting tools exclusively . . . this assures a high standard of perfection. There's longer life between sharpenings in the Wendt-Sonis line . . . the marked preference of tool engineers for W-S tools is evidence of this.

W-S FACTORY TRAINING COURSE . . . FREE!

One week's intensive training, at our factory, in application, use and maintenance of carbide cutting tools. Small classes, individual instruction. Practical facts, actual shop practice. Write for details.

FREE! new cutting tool catalog 445

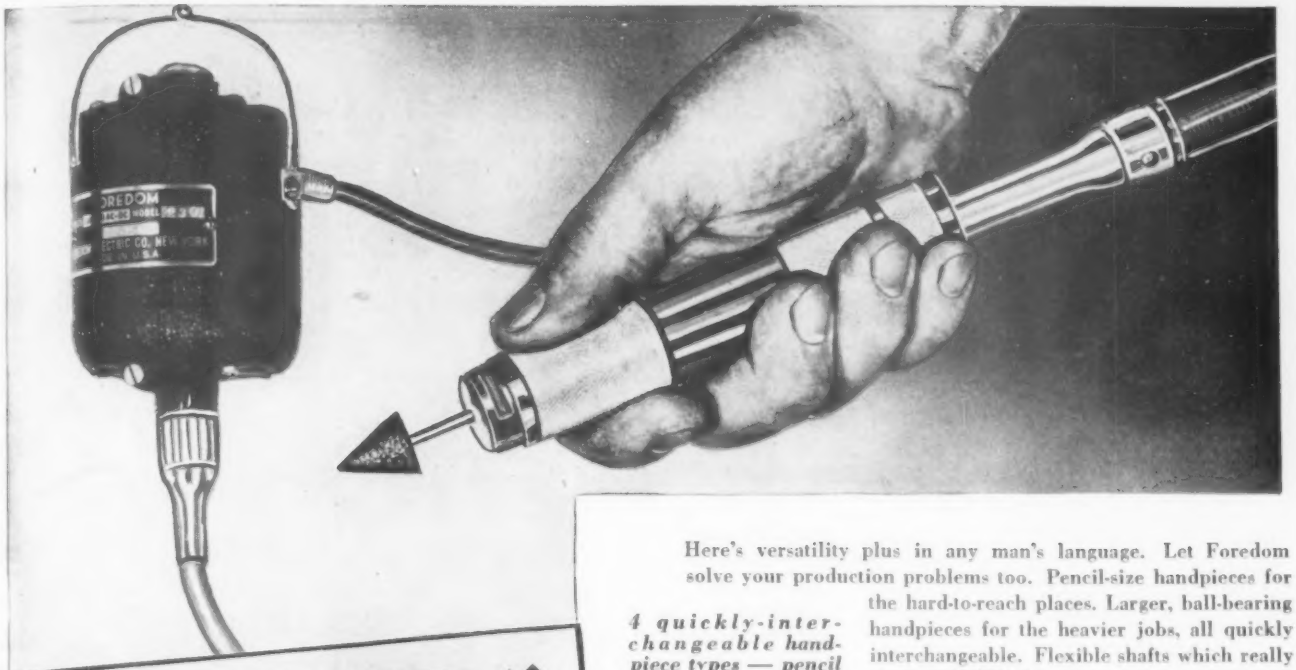
Write Wendt-Sonis Company, Hannibal, Missouri. Contains specifications and latest prices on all these carbide tipped tools:

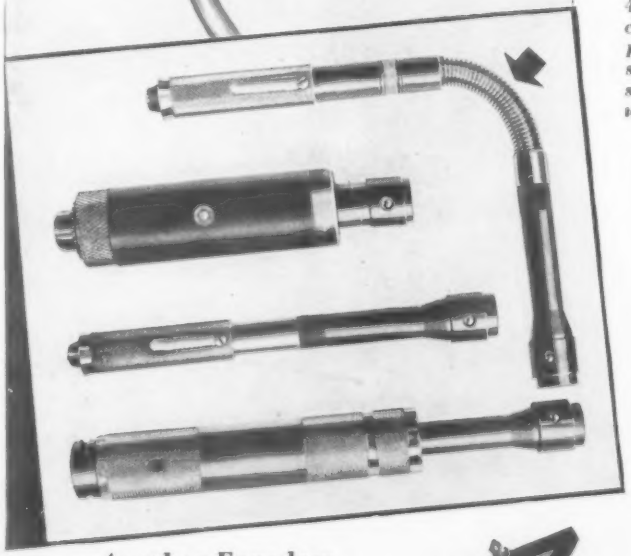
REAMERS • END MILLS • LATHE CENTERS • SPIRAL REAMERS • BORING TOOLS • STUB SPOT FACERS • SLOTTING CUTTERS • COUNTERBORES and SPOT FACERS • END MILLS • FLY CUTTERS • CORE DRILLS • ROLLER TURNING TOOLS • SPIRAL END MILLS • GRINDER HALF CENTERS • CUT-OFF TOOLS • TWIST DRILLS

Saving MAN HOURS in thousands of American plants

in the DEBURRING AND FINISHING OF small PARTS

Foredom FLEXIBLE SHAFT MACHINES





4 quickly-interchangeable handpiece types — pencil sizes and larger — some with flexible wrist—see arrow.

Here's versatility plus in any man's language. Let Foredom solve your production problems too. Pencil-size handpieces for the hard-to-reach places. Larger, ball-bearing handpieces for the heavier jobs, all quickly interchangeable. Flexible shafts which really ARE FLEXIBLE.

3 Ways Right!

1. For de-burring, grinding, finishing, polishing and other light production jobs—particularly valuable on irregularly-shaped parts.
2. In tool and die departments, for grinding, finishing and touching up dies, molds, jigs, etc.
3. For maintenance and emergency needs—touching up set-ups without disassembly, removing high spots on gears, identification marking of equipment, etc.

THOUSANDS OF PLANTS USE FOREDOMS, including Ford, General Motors, Chrysler, Nash-Kelvinator, Jack & Heintz, Sperry Gyroscope, Bendix, Westinghouse, etc.

Models from $17.50 to $48.75. Catalog No. 77 shows a complete line and many uses—may point the way to solving some of today's production and maintenance problems. Write for your copy.

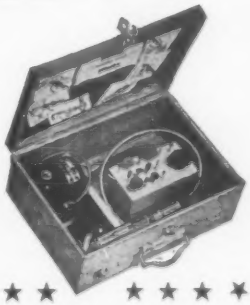
Order from your regular Mill Supply House or direct.

FOREDOM ELECTRIC CO., 27 Park Place, N. Y. 7

Another Foredom Time-Saver

Grinding Kit, Model 111

One of Foredom's complete line of versatile utility grinding kits preferred by so many plants for emergency and maintenance needs. You too will find it pays to spot them liberally about your plant. Pencil-size handpiece facilitates getting into tight corners for touching-up production set-ups. Complete with accessories $23.50.



FOREDOM ELECTRIC CO., 27 Park Place, New York 7, N. Y.

Please send me your new catalog No. 77 showing the different uses of Foredom Flexible Shaft Machines.

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Screw Machine CAMS

For.. **CECO • GIBBS • TORNOS**
GORTON • WICKMAN • POLYMATIC
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IF YOU ARE INTERESTED IN CAM DESIGN FOR BROWN & SHARPE AUTOMATC SCREW MACHINES CONTACT US AND GET YOUR NAME ON OUR MAILING LIST.

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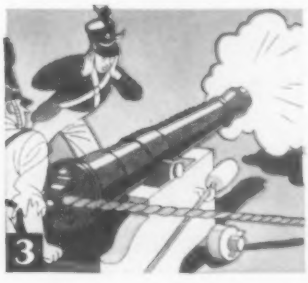
GEORGE L. DETTERBECK
Company

1871 CLYBOURN AVENUE
CHICAGO 14, ILL.

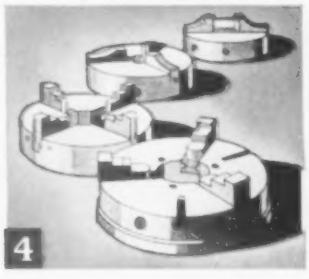
First you've gotta know what a chuck is

Chucks hold tools or work that are in motion.

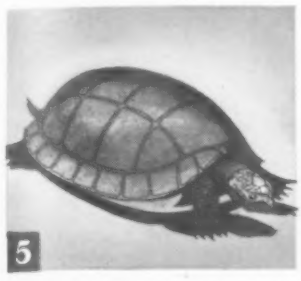
Chucks owe their origin to the ancient potter's wheel.



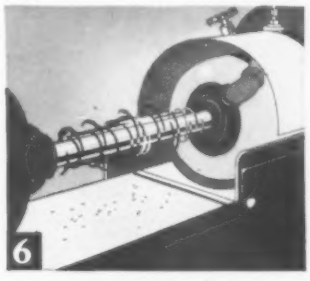
First chucks were used for making cannon in War of 1812.



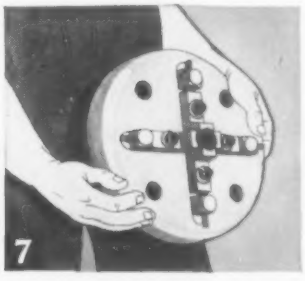
There are many kinds of chucks. Here are some in common use.



Many chucks are too "slow" for modern high-speed production.

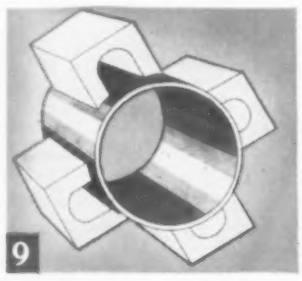


Other chucks aren't positively true —lack hair-splitting accuracy.

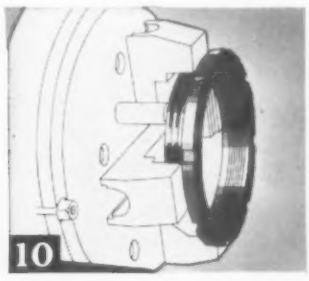


New and better is the amazing Woodworth Diaphragm Chuck.

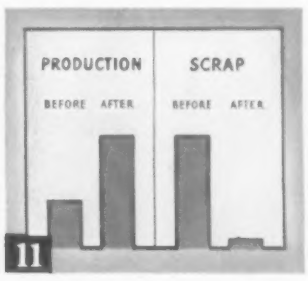
Jaws fasten to diaphragm which flexes like bottom of oil can.



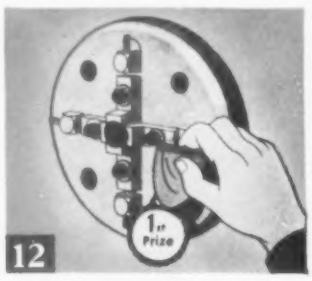
Thin-walled parts won't distort in machining to close accuracy.



Large, heavy parts can be processed with fine precision.



Steps up production 2¼ times—scrap practically eliminated!



A winner! Industry acclaims Woodworth Diaphragm Chuck!

What Woodworth Products Mean to Industry

THE DIAPHRAGM chuck is a typical Woodworth contribution to mass production efficiency. Here's why.

Every Woodworth product must conform to the basic policy of this company—*TO MAKE ONLY PRODUCTS WHICH WILL BENEFIT INDUSTRY THROUGH INCREASED PRODUCTION AND REDUCED COSTS.*

This means that the great demand for Woodworth Tools and Gages will be continuing, especially in view of the coming battle for postwar markets.

And it means that Woodworth engineers have been charged with the responsibility of searching constantly for new ways to speed up and lower the cost of production, in connection with Woodworth Products of the future.

The constant growth and expansion of the N. A. Woodworth Company is due to strict adherence to these objectives.

ACCURACY YOU W CAN TRUST

WOODWORTH

N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD, DETROIT 20, MICHIGAN

PRECISION GAGES

PRECISION MACHINED PARTS

PRECISION TOOLS

Save DRILLING Time WITH SUBLAND OIL-HOLE DRILLS!

A Cool Cutting Edge
Means Faster Drilling

You can perform 2-step drilling with Subland Oil-Hole Drills much faster than with ordinary subland drills for the simple reason that there is never any danger of the drill overheating. Because of its cooling feature, an Oil-Hole Subland Drill remains sharp much longer, having a life two to three times that of ordinary drills. Remember this the next time you need drills for 2-step drilling!

Made to Specifications!

All sizes from ½" to 3½" in diameter and up to 36" overall. Please specify taper or straight shank. We also specialize in the manufacture of all types of subland drills and reamers.

Straight Shank — Morse Taper Shank

DETROIT REAMER & TOOL CO.

2830 E. 7 Mile Road, Detroit 12, Mich.

Manufacturers of Oil-Hole Drills, Special Reamers, Circularity Relieved Reamers, End Mills and Special Tools.

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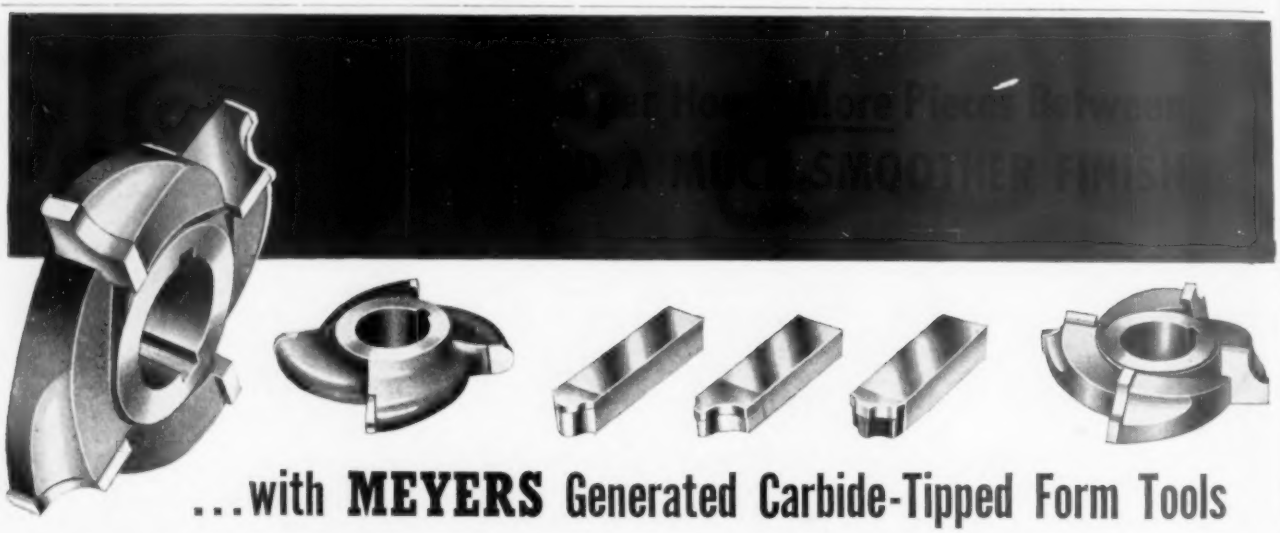
Service with a punch!

● Allied's R-B Interchangeable Punch and Die is "standard" in metal working and plastic industries. Standard shapes and sizes carried in stock. Illustrated are four of the thousands of specially-designed punches we have made. Special R-B punches and dies made in any material, shape or size desired. Send for large, illustrated R-B catalog, now.

ALLIED PRODUCTS CORPORATION

Department 28-E • 4630 Lawton Ave. • Detroit 8, Michigan



...with MEYERS Generated Carbide-Tipped Form Tools

● The Meyers method makes it possible to grind the most intricate forms on carbide-tipped tools with extreme accuracy, enabling you to get more pieces per hour, more pieces between grinds, and a much smoother finish. On an actual production job Meyers Generated Carbide-Tipped Tools have reduced cutting time per piece from 40 seconds to 7 seconds, and increased pieces between grinds from 100 to 400. This amazing performance resulted in an actual production increase of 571%.

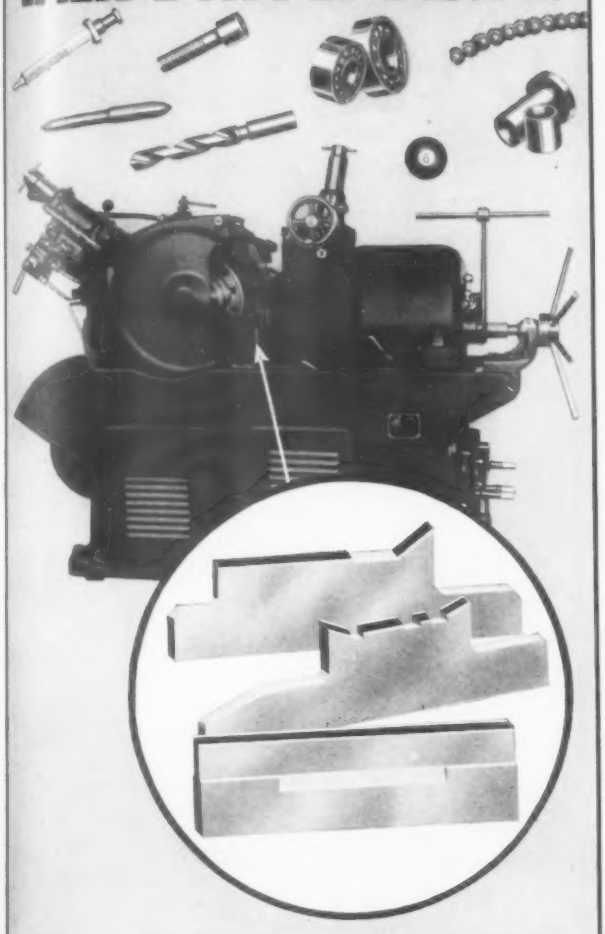
Comparison proves the superiority of these tools. Send us your prints for a quotation.

W. F. MEYERS CO., INC.

ESTABLISHED 1888

1024 14th Street *Bedford, Indiana*

CENTERLESS GROUND *with* TALIDE-TIPPED BLADES



Talide-Tipped Blades, with Tungsten Carbide wear strips, have become standard equipment for centerless grinding armor-piercing shot, shells, projectiles, bullet cores, aircraft parts and other ordnance material

The extra long life of super-hard Talide Blades, plus their natural ability to resist scoring and galling, have helped to increase the production of precision ground parts by eliminating down-time and rejects.

In the post-war period, Talide-Tipped Blades will be used to increase the production of lower cost roller bearings, fountain pens, cap screws, twist drills, bushings and a wide variety of shafts, spindles and screw machine products. Write for catalog 43-WP listing full particulars and prices.

TIPPED WITH TALIDE TUNGSTEN CARBIDE

METAL CARBIDES CORPORATION YOUNGSTOWN, OHIO

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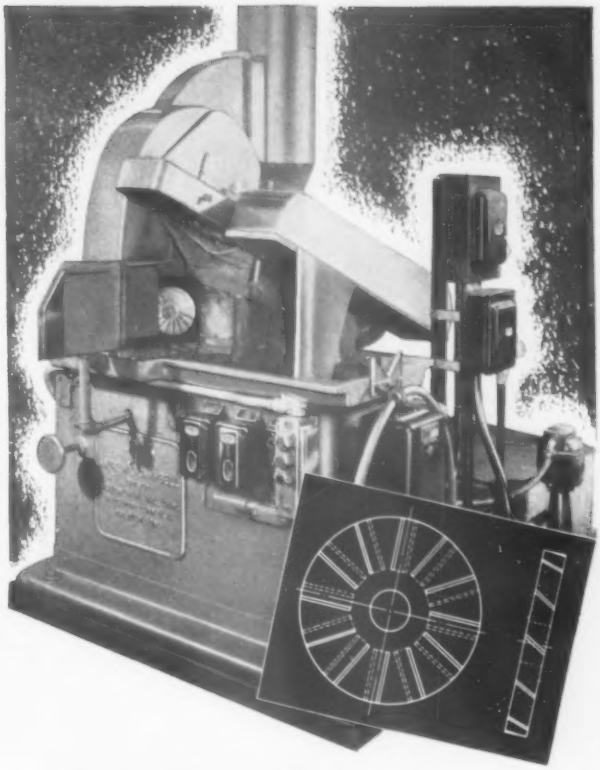
YOUNGSTOWN 5, OHIO
TUNGSTEN CARBIDE TOOLS · DIES · WEAR PARTS



CUTTING PRODUCTION TIME
FROM MINUTES TO SECONDS

PROBLEM: To cut angular slots in a disc 8" in diameter, approximately 1¼" thick, going in from the periphery (see sketch). The material was heat-resisting stainless steel. The way the manufacturer was doing this job required a larger battery of machines to meet production requirements and it would take minutes to make each cut.

SOLUTION: A **CAMPBELL MODEL NO. 401 CUTAMATIC WET ABRASIVE CUTTING MACHINE** was rearranged to receive an automatic indexing fixture which compensates for wheel wear and depth of cut. The time required for cutting each slot (approx. 2 sq. in.) is 15 seconds. One operator can run all machines required for full production schedule.

★ ★ ★

Unusual? Yes. We are constantly adapting **CAMPBELL ABRASIVE CUTTING MACHINES** to do unusual jobs—or to do ordinary jobs faster, better or at lower cost. Perhaps we could solve a cutting problem for you. We'll be glad to talk it over.

Campbell

ABRASIVE CUTTING MACHINES

ACCO

ALSO MAKERS OF A COMPLETE LINE OF NIBBLING MACHINES

ANDREW C. CAMPBELL DIVISION
AMERICAN CHAIN & CABLE · BRIDGEPORT, CONN.

RED-E-TOOLS

Cemented

CARBIDE TIPPED CENTERS

Made with points of a specially high grade Cemented Carbide having a Rockwell hardness of 78 Rockwell C Scale, as compared with 66 for hardened Tool Steel, resulting in unusual wear resistance, often as much as 100 times that of Tool Steel. This unique metal also resists abrasion, erosion, corrosion and oxidation under the electric arc. It has a tensile strength of 210,000 to 240,000 lbs. per sq. inch.

Points are generous in size and the carbide extends well back into the shoulder to assure ample support even after grinding. The RED-E Safety "Life-Line" around the shoulder clearly shows the maximum safe grinding limit.

RED-E Carbide Centers are also made in BULL TYPE for work with large center hole. In Bull Type Centers, a steel plug extending clear through the center of the carbide assures rigidity and at the same time provides a center for customers' regrinding. Bull Type Centers are available as shown without shoulder (Type 1) or with 1/16" or 1/8" shoulders (Types 2 and 3).

Write for RED-E Lathe and Grinder Center Bulletin No E-45

THE READY TOOL COMPANY
Iranistan & R. R. Avenues
Bridgeport, Connecticut

BULL TYPE CENTERS

OTHER RED-E PRODUCTS YOU SHOULD KNOW...

CEMENTED CARBIDE TIPPED LATHE & GRINDER CENTERS with the RED-E Safety "Life Line"

HIGH SPEED STEEL CENTERS

RED-E NEW DEPARTURE BALL BEARING CENTERS

RED-E STYLE X LATHE TOOL with the Tool Steel Bearing

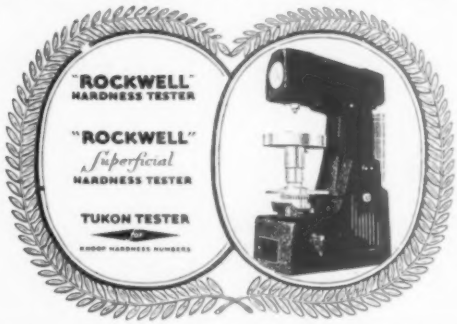
MILLING MACHINE & FACE PLATE DOGS

GRINDER DOGS

RED-E-TOOLS

Bulletins on any or all of these Products on request.

WILSON M.I.C. IS EVER AT WORK IN PEACE AS IN WAR TO IMPROVE AND EXTEND FACILITIES FOR PRECISION HARDNESS TESTING.



THOUSANDS OF THEM ARE USED IN AMERICA, AND THOUSANDS IN FOREIGN COUNTRIES, DUE ENTIRELY TO REPUTATION FOR ENDURING ACCURACY

WILSON
MECHANICAL INSTRUMENT CO. INC.
230 CONCORD AVE., NEW YORK 54

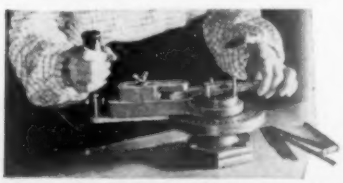
AN ASSOCIATE COMPANY OF AMERICAN CHAIN AND CABLE COMPANY, INC.

Talk About PRODUCTION Without DIES!

4,000 Parts Per Day with DI-ACRO Bender

"Enclosed are pictures taken in our plant which prove the DI-ACRO Bender will do a real production job. We are making 4,000 completed parts per day which is competitive to most Power Presses." (Name on request.)

Here is an example of "DIE-LESS DUPLICATING" typical of a great variety of formed parts readily made with DI-ACRO Precision Machines,—Benders, Brakes, Shears. Picture below shows an acute right angle bend and photograph above shows the finished part formed to die precision. Women operating DI-ACRO UNITS maintain a high out-put on production work.



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DI-ACRO is pronounced "DIE-ACK-RO" →

O'NEIL-IRWIN MFG. CO.

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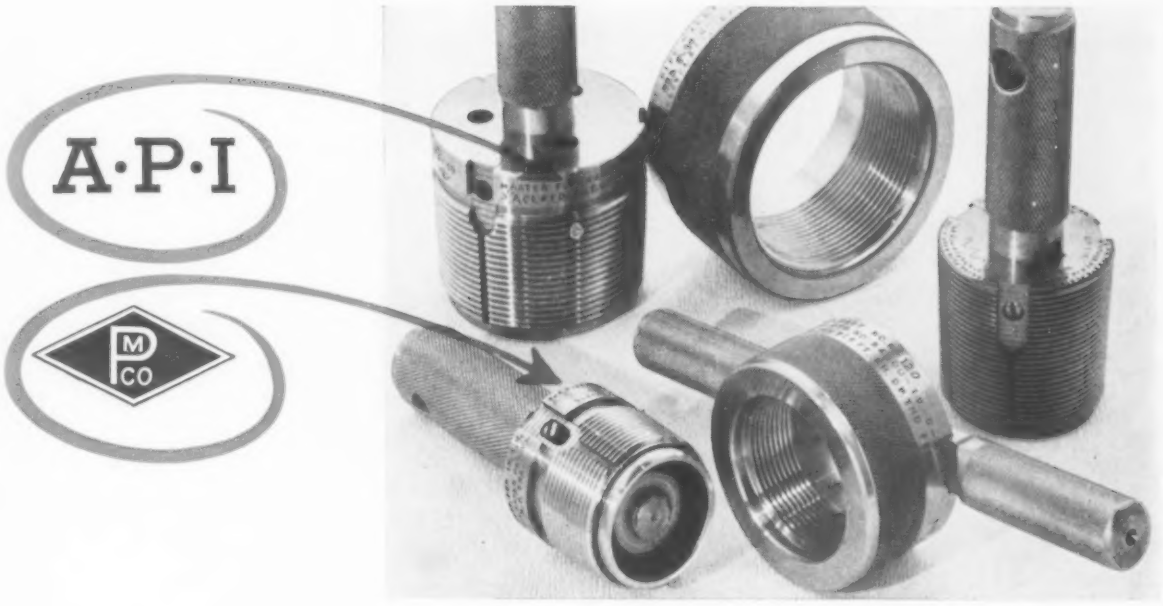
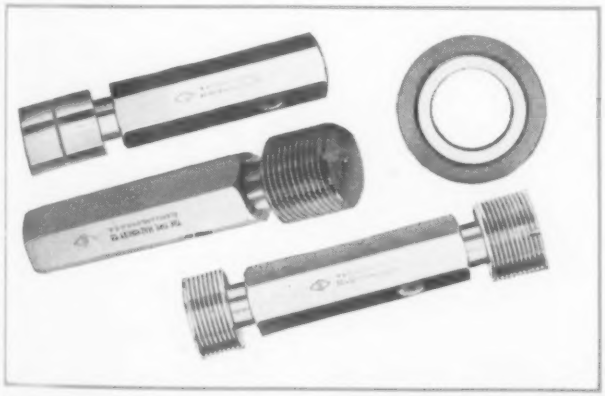
DOUBLE ASSURANCE OF ACCURACY



Precision manufacturers know they can rely with full confidence on any Gage that bears the PM Diamond emblem.

On gages made for the petroleum industry, we are also privileged to use the A. P. I. emblem, indicating that they conform to the high thread standards of the American Petroleum Institute and have been checked against master gages approved by the Federal Bureau of Standards.

Here is double assurance, of both initial accuracy and the perfection of finish that means long life.



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Pipe Machinery carries a large stock of standard types of gages, from which prompt shipments can be made on short notice. For special gages, built to your specifications, let us quote prices and delivery dates.

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The PIPE MACHINERY COMPANY Cleveland, O.

GAGES • MULTIPLE THREAD MILLING CUTTERS • SPECIAL TOOLS

The Ideal Material for *LAYOUTS* on FORM GRINDERS

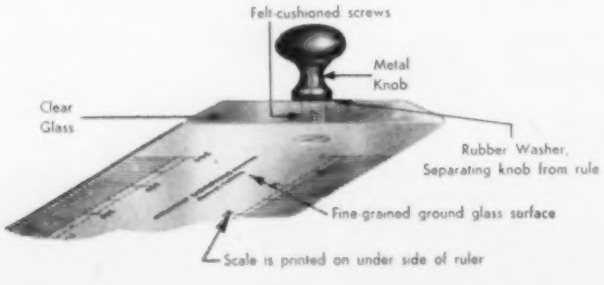
Detail Engineers'-Glass has been available less than a year. During this time it has been used on all types of optical comparators, for it has been demonstrated that its employment saves time; assures accuracy and speeds up inspections.

Those who have used it on Form Grinders (50X magnification), have found it is not only "the ideal material" on which to produce layouts, but that its graph of blue lines adds a plus value in that they eliminate mathematical calculations.

The adaptability is three fold: Scale drawings may be made with a hard pencil; for permanent charts these lines may be inked in; if a number of charts are needed, they may be sent to us for reproduction as Engineers'-Transparencies—as many exact duplicates as you require can be made.

Write for new folder illustrating and describing further this adaptation

The New UNIVERSAL LAYOUT SCALE —50X Magnification—designed especially for use with Detail Engineers'-Glass on Form Grinders. Note features.


Felt-cushioned screws
Metal Knob
Clear Glass
Rubber Washer, Separating knob from rule
Fine-grained ground glass surface
Scale is printed on under side of ruler

ENGINEERS SPECIALTIES DIVISION

The UNIVERSAL ENGRAVING & COLORPLATE COMPANY, Inc.

980 ELLICOTT STREET BUFFALO 8, NEW YORK — TWIN PLANTS — 1919 EAST 19th STREET CLEVELAND 15, OHIO

FULL SPEED AHEAD

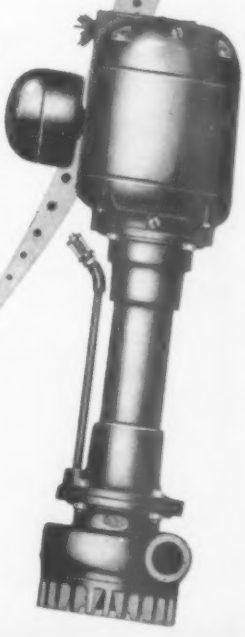
★ with a Pioneer Pump supplying one of the important factors affecting the speed of metal removing operations. The major conditions governing cutting speed are the composition of stock and tool, feed and depth of cut, the coolant used and the method of getting it to where cutting action is taking place.

Pioneer Pumps, the most efficient coolant distributors in use today, send a steady stream of liquid to the point where it is needed. Most cutting operations will show increased feet-per-minute production when the proper coolant is supplied by a Pioneer Pump.

Among Pioneer's 400 standard models you are sure to find the pump which will give the "full speed ahead" signal to your machines.

PIONEER MODEL V

normally rests directly on bottom of tank or reservoir, but tank brackets and flanges are available to facilitate mounting on edge, side or top. Foot grille provides clearance for unobstructed flow and prevents entrance of large pieces of foreign matter. Outlet boss may be specified 90° or 180° from position shown.



PIONEER *Pumps*

HIGH EFFICIENCY • LOW POWER CONSUMPTION GREATER VOLUME AND LESS MAINTENANCE

Pioneer Pump & Manufacturing Co.

19645 JOHN R ST. • DETROIT 3, MICHIGAN

FOR EXTRA SPEED AND ECONOMY

Replace Those Old-Style Solid Cutters . .

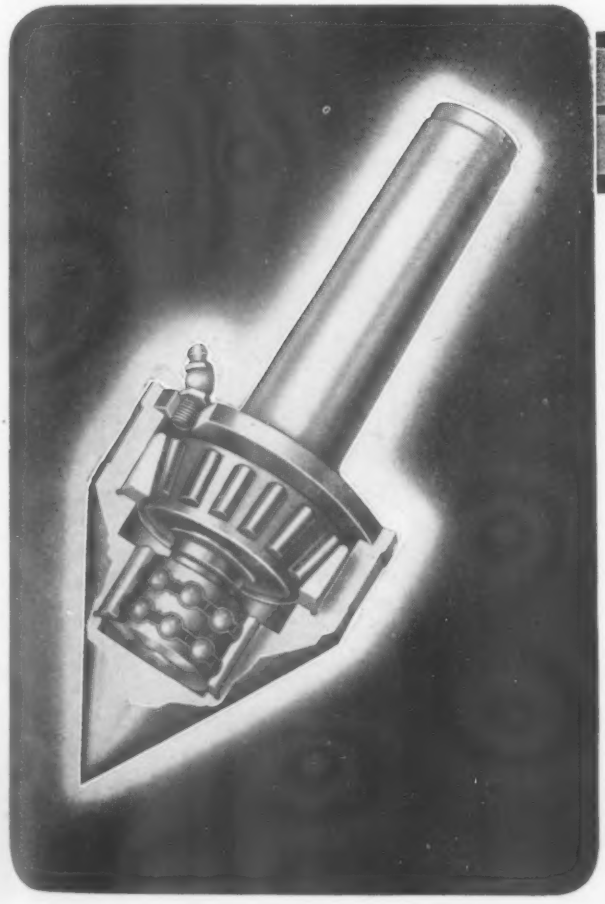
From now on, competition will steadily increase. To meet it successfully, replace your solid milling cutters and lathe, planer and shaper tools with these modern designs. In these tools, only the cutting edges are made of cutting steel; the holders, or bodies, are made of less expensive, but exceedingly strong, alloy steel. With the "O K System," the bits or blades may be readily adjusted in line of wear, or replaced with different designs. You handle a wider variety of work and get more out of your tools.

Describe your problem. We'll be glad to help you to solve it.

THE OK SYSTEM
OF INSERTED-BLADE METAL CUTTING TOOLS

FREE — a new and complete instruction book on the grinding of milling cutters. Simply told, profusely illustrated. Send for it now.

THE O K TOOL CO., SHELTON. CONN.



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LIVE CENTERS
VS.
LIVE TAIL STOCKS

A breakdown in a Live Tail Stock entails from 2 to 5 hours work stoppage. A MARVECO can be changed in less than 2 minutes.

The MARVECO is GUARANTEED to OUTPERFORM and OUTLAST any other LIVE CENTER.

Our illustrated catalog will be sent upon request. See for yourselves the MARVELS of MARVECO.

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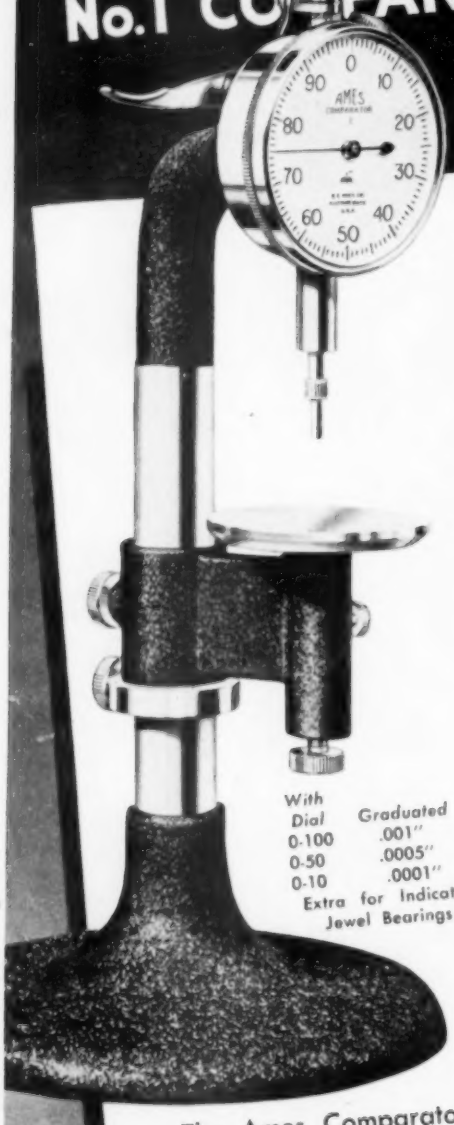
CENTER PROBLEMS

MARVEL TOOL & MACHINE CO.
10981 W. JEFFERSON AVE, RIVER ROUGE 18, MICHIGAN

AMES No. 1 COMPARATOR



With Dial	Graduated	Price
0-100	.001"	$30.00
0-50	.0005"	30.00
0-10	.0001"	45.00

Extra for Indicators with Jewel Bearings $3.00

The Ames Comparator No. 1 stands 9½" high, has a table that is adjustable for height and will measure objects up to 2" in cross section. The indicator is 2¼" in diameter and offered in a variety of dial graduation numberings and values. The lever at left is pressed down to lift the indicator spindle, while releasing it permits the spindle to return quickly.

Other models are shown in catalog No. 54.

Send for a copy.

B. C. AMES CO., WALTHAM, MASS.

SIMPLICITY . . . EASE OF CHANGE
From Internal to External Makes

PARKER-MAJESTIC

LEADER IN THE GRINDING FIELD

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For Precision Grinding

Features . . .

- HAND OR POWER FEED . . . . . .
- DEAD AND LIVE CENTER DRIVE . . . .
- OSCILLATING TABLE ACTION . . . .
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Representatives in All Principal Cities

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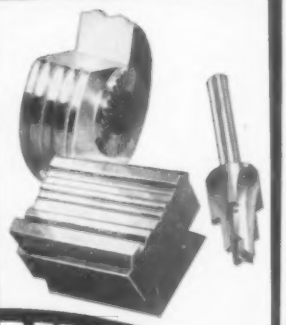
ENGINEERED TO THE JOB . . . PRECISION MADE FOR EXACTING PERFORMANCE AND

*Mastercased** TO GIVE UP TO

500% LONGER LIFE



MASTERFORM

HIGH-SPEED
**Mastercased* CUTTING TOOLS*

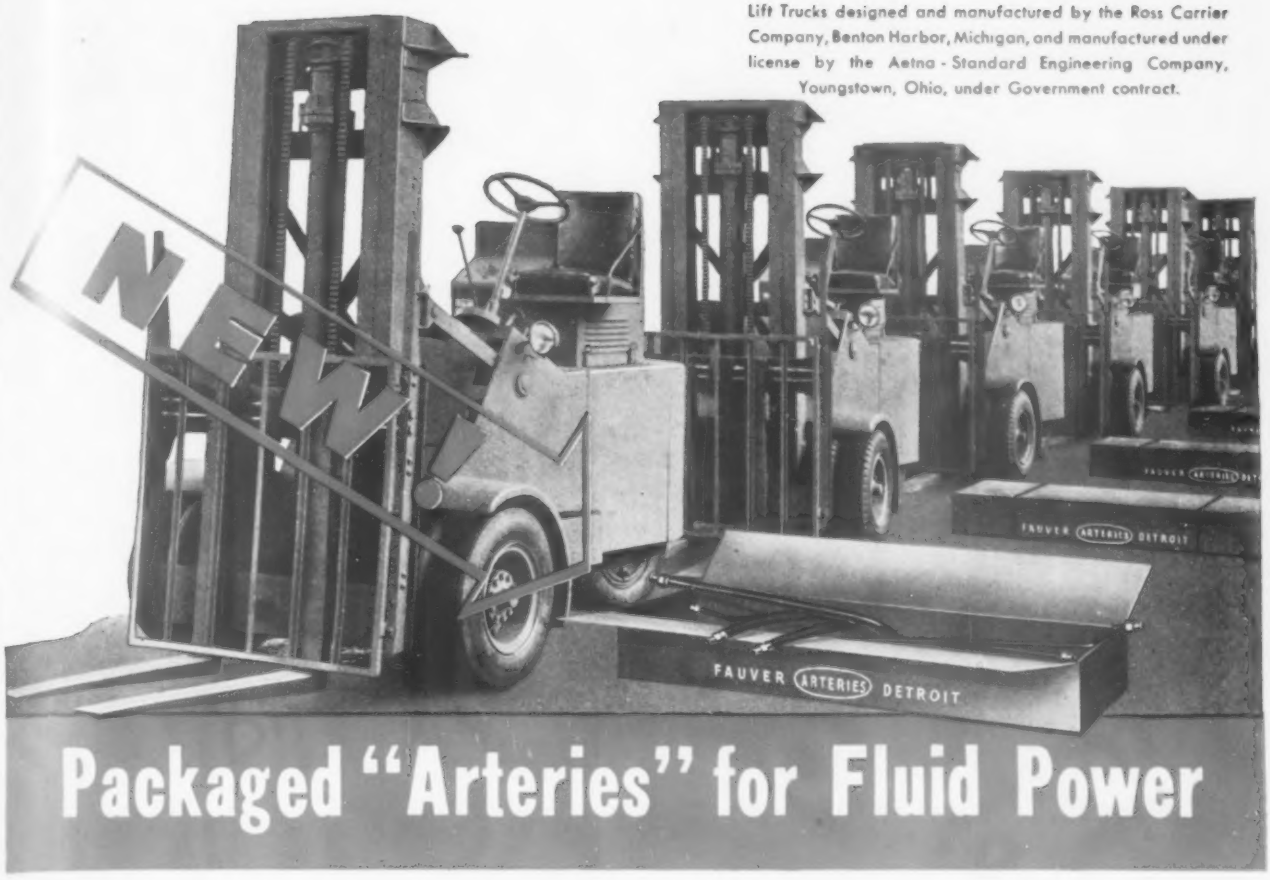
Meet the Challenge

**Mastercasing . . .*

That's our improved super-heat-treating process which adds to the life of Masterform cutting tools . . . will multiply your production . . . will divide your costs per cut.

Want proof? Write, wire or phone for name of nearest-to-you factory representative . . . or without the slightest obligation, send specifications for estimates and complete information.

MASTERFORM TOOL CO.
2550 IRVING PARK ROAD • CHICAGO 18, ILL.
OUTSTANDING ENGINEERING SERVICE AND CRAFTSMANSHIP



Lift Trucks designed and manufactured by the Ross Carrier Company, Benton Harbor, Michigan, and manufactured under license by the Aetna - Standard Engineering Company, Youngstown, Ohio, under Government contract.

Packaged "Arteries" for Fluid Power

SPEED ASSEMBLY OF LIFT TRUCKS

with Unit Kits of Fauver Flexible Hose Assemblies, Prefabricated Tubes and Parker Fittings

Moving or adjustable parts are connected with hose assemblies by tightening two nuts. Precision-made tube shapes are placed instantly and attached the same way. Compare this with fitting, cutting and threading a multitude of pipe lengths and laboriously screwing them into a multiplicity of pipe fittings. Think of the saving in labor and material costs, how inventories are simplified, the ease of making repairs!

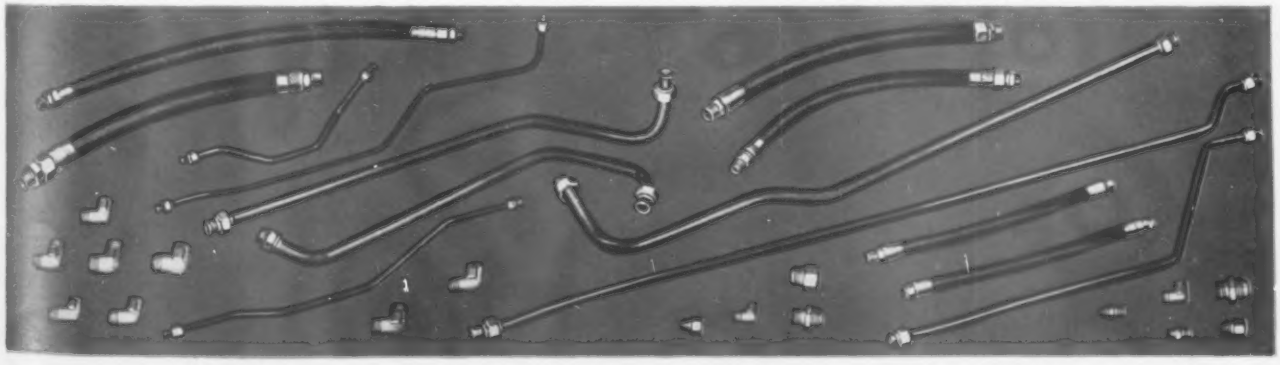
AS FEW AS 25 KITS PREFABRICATED ECONOMICALLY

Individual packaging of the complete set of "hydraulic arteries" for each unit, aids stream-lined assembly on the production line. Fauver will gladly assist in engineering the complete fluid power kit for *your* machine or vehicle.

Consult Us Today.

J. N. FAUVER CO.

53 W. Hancock Ave. • Detroit 1, Michigan



Each Fauver Kit includes the above prefabricated steel tubing, hose and Parker fittings for the fluid power assembly of each lift truck.

The properties that make Kennametal outstanding for fast, economical machining of steel, cast iron, non-ferrous metals, and non-metallics, are equally useful when applied to a variety of other production processes. Shown on this page are a few examples that suggest scores of economic applications of Kennametal on special tools, dies, and rolls.

Kennametal is the tough, strong, cemented carbide that contains an extremely hard intermetallic compound, $WTiC_2$. Its superior wear-resistance comes from a combination of precisely maintained properties—high modulus of elasticity (2 to 3 times that of steel); low coefficient of friction; and exceptional hardness (up to 92.3 on Rockwell A scale).

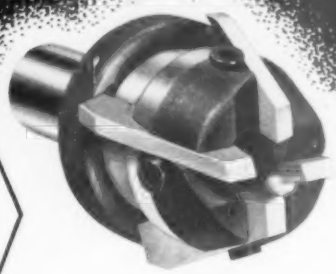
Kennametal can be accurately molded into almost any shape, limited only by reasonable proportions. Its cost is moderate—almost insignificant when compared with the tool and production economies effected through its use. The best way to prove this is to let us cooperate with you in designing a Kennametal tool for test purposes on your specific job.

Remember, Kennametal can be used in your production machines without entering into any complicated, continuing agreements.

KENNAMETAL
SUPERIOR CEMENTED CARBIDES
KENNAMETAL Inc. . LATROBE, PA.

GENESEE

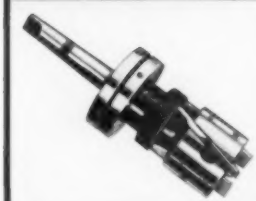
ADJUSTABLE HOLLOW MILLS WILL INCREASE YOUR PRODUCTION



STYLE M • Blades set at rake angle for cutting steel, aluminum, and other materials requiring rake.

INSERTED BLADE FACING & COUNTERBORING TOOLS

SPECIAL HIGH PRODUCTION TOOLS



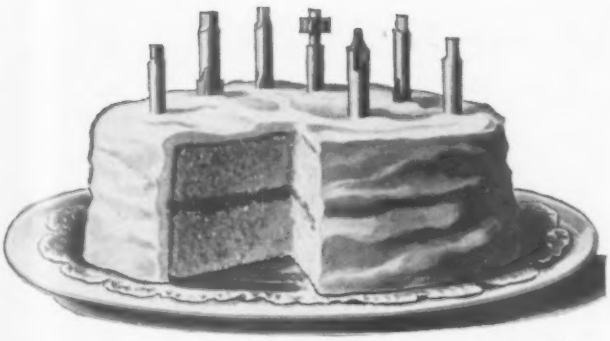
• THERE IS A GENESEE for every hollow milling job. Available in 16 styles. Standard sizes from 0 to 2", with straight or Morse taper shanks carried in stock . . .

- Each size tool has 1/8 range.
- Blades quickly ground in a simple fixture.
- All tools manufactured of heat-treated alloy steel.
- Adjusting threads are ground from the solid and adjusting rings are lapped for extreme accuracy.
- Available with high speed steel, cast-alloy, or Tungsten Carbide tipped blades.

Genesee Tools will increase your production—35 years of know-how is yours for the asking . . . Write for complete catalog No. 45.

GENESEE MFG. CO., INC.
GENESEE
EST. 1908
ROCHESTER 4, N.Y.

ADJUSTABLE HOLLOW MILLS • FACING AND COUNTERBORING TOOLS • SPECIAL PRODUCTION TOOLS



You CAN Have Your Cake — and Eat It!

You can profit by the economy of straight shank small tools (as compared with taper shanks) yet keep the convenience and speed of taper shanks by driving them with

Glenzer UTILITY DRIVERS

Each Glenzer Driver outlasts many small tools and provides a removable taper for each one.

Customers Report 40% to 75% Savings

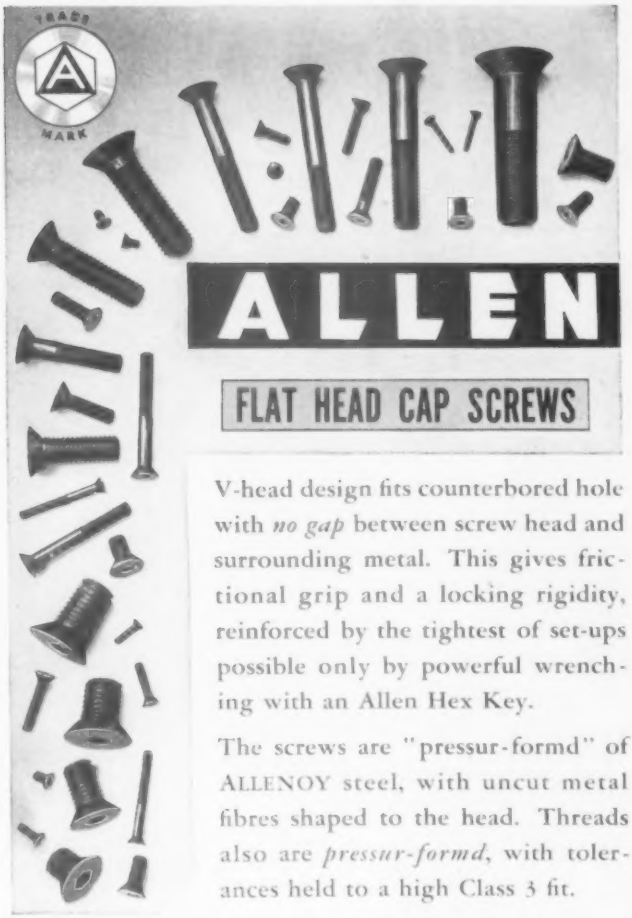
Glenzer Utility Drivers (Sleeves) are made in all standard tapers and for all small tool sizes—either decimal, fractional, numbered or lettered.

Drive your drills, reamers, taps, end mills, key slot cutters and similar small tools the Glenzer Way for maximum efficiency and economy. *Utility Tools*

SHIPPED FROM STOCK

Also made for Republic Shankless Drills

THE J. C. **GLENZER** CO., Inc.
6467 EPWORTH BLVD. DETROIT 10, MICH.



ALLEN

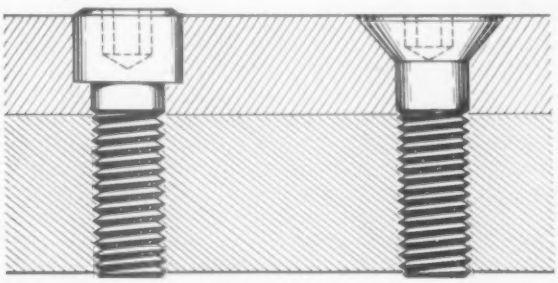
FLAT HEAD CAP SCREWS

V-head design fits counterbored hole with *no gap* between screw head and surrounding metal. This gives frictional grip and a locking rigidity, reinforced by the tightest of set-ups possible only by powerful wrenching with an Allen Hex Key.

The screws are "pressur-formd" of ALLENOY steel, with uncut metal fibres shaped to the head. Threads also are *pressur-formd*, with tolerances held to a high Class 3 fit.

ALLEN FLAT HEAD CAP SCREWS

set up *flush* in holding comparatively thin plates or superposed parts, without weakening the metal with deep countersink.



Above diagram shows how flush surface is achieved with shallow countersink as compared with ordinary socket head cap screw. Note more binding surface under the head than is had with a fillister or cheese-head type. The angle helps lock screw in place by drawing down on a conical surface.

Your local Industrial Distributor supplies also Allen Socket Head Cap Screws, Hollow Set Screws, "Tru-Ground" Shoulder Screws and "Tru-Ground" Dowel Pins. Ask him for samples and details.

THE ALLEN MFG. COMPANY
HARTFORD, ★ ALLEN ★ CONN.

NOW... YOU CAN USE SHORT PIECES OF SCRAP TOOL BITS AS REPLACEMENT CUTTERS

Insert in bar.
Complete cutter bar and insert showing cutting edge.
The micrometer dial of the insert has 25 graduations, each being one-thousandths of an inch.

Write at once for complete descriptive bulletins.

Quick, enthusiastic acceptance was received for this new time and money-saving boring-bar insert. It has many advantages found in no other insert.

NASH-ZEMPEL
BORING-BAR INSERT

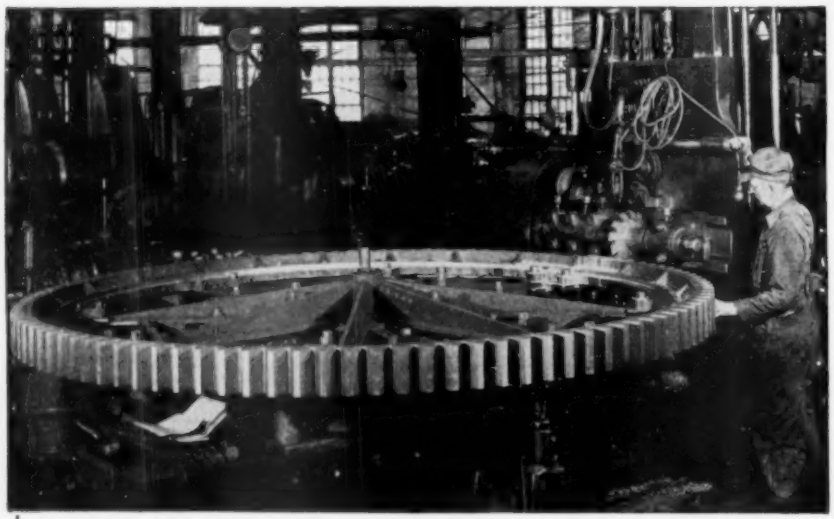
It is unnecessary for you to come to us for cutter replacements. Cutters can be made in your own shop from scrap bits of hi-speed steel. No special tools necessary. Only a simple grinding operation required.

The insert can be installed in any bar available by a simple boring and milling operation. The locating head of the boring-bar insert fits snugly into the recessed slot of the bar. The set screw in the boring bar locates the insert and draws the head firmly against the shoulder of the recessed slot in the bar. Accurate location point is always maintained. *The Nash-Zempel boring-bar insert is available in forty standard sizes, with special sizes on request.*

NASH-ZEMPEL TOOLS

Division of J. M. Nash Company

2354 NORTH 30TH STREET • MILWAUKEE 10, WISCONSIN



"David and Goliath"

NATIONAL TOOL PRODUCTS

BROACHES • HERRINGBONE CUTTERS
SLITTING SAWS • COUNTERBORES
REAMERS • GEAR SHAPER CUTTERS
GEAR CUTTERS • MILLING CUTTERS
CIRCULAR AND FLAT FORM TOOLS
HOBS, GROUND AND UNGROUND

National Tools are the Shapers of Progress

From Blueprint to Product

"David and Goliath"

At the Marion Steam Shovel Company, Marion, Ohio, where power shovels are built from ¾ cu. yd. to 35 cu. yds. capacities, huge dimensions at precision tolerances are commonplace production practices.

To assure that close tolerances are preserved on the modern "Goliaths" of Steel which form a Marion machine, tools selected must measure up to the tremendous job before them. Thus we see little "Davids" in the shape of modern National Tool cutters mastering huge gears 118-10" in diameter with 140 teeth and doing it to close gear limits.

The huge gear illustrated here is the main rotating gear for the Marion 4161 electric shovel. This shovel is popular in copper mines where many of them are working in the country's foremost open pit mines on a twenty-four hour schedule.

NATIONAL TOOL Co.

11200 MADISON AVENUE CLEVELAND, OHIO

COMPLETE LINE OF HEAT TREATING PRODUCTS

Park

LABORATORY CONTROLLED PRODUCTS

DRAWING SALTS
QUENCHING AND TEMPERING OILS
HIGH SPEED HARDENING AND CASING SALTS
NEUTRAL SALTS
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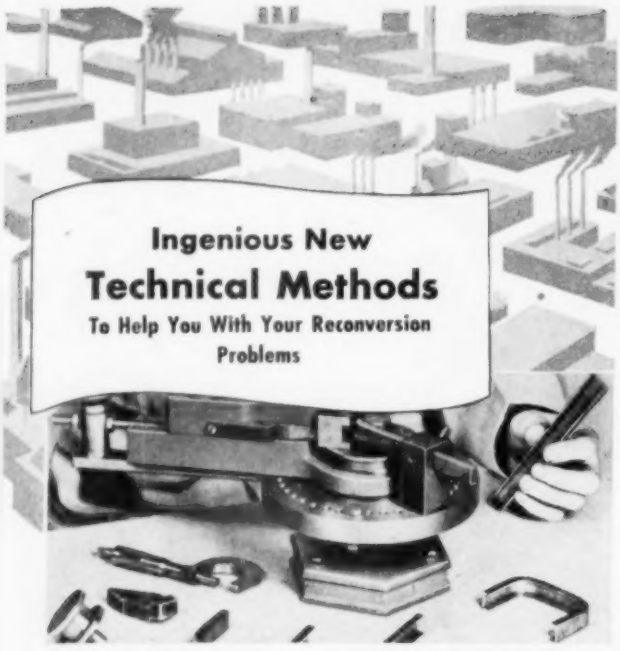

"DIE-LESS DUPLICATING" ELIMINATES TIME LOSS AND DIE EXPENSE!

The DI-ACRO Bender is a precision unit, designed to form and duplicate an unlimited variety of parts and pieces—eliminating, in many cases, the need for special dies. Tubing can be accurately formed with the DI-ACRO Bender to a center line radius as small as 2½ times the outside diameter of the tube without distortion. Shapes and outlines, impossible to obtain with regular production dies, are easily formed with the DI-ACRO Bender. These include round, half-round, hexagon, and square rod, tubing, angle, channel, moulding, strip, stock and bus bar.

Typical Shapes Formed by the DI-ACRO Bender

Stops may be set and material guides mounted for production work in excess of 1000 operations per hour. The Bender is compact and portable, ideal for temporary or permanent work. There are no extra parts to purchase, as the DI-ACRO Bender has been built to cover a wide working range, with simple conversions.

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Z-87

That Unseen Extra Quality

An Accurate "Pitch" is Necessary

But absolute control of "LEAD" and "ANGLE" as well as "PITCH" is vitally important in a thread gage.

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GAGES OF LONG LIFE ACCURACY

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"PLUNGER" DE-STA-CO. Clamp

No. 610

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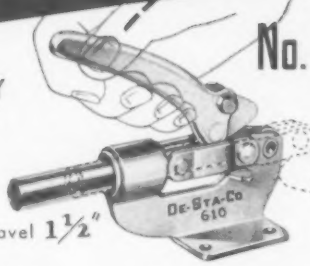

Plunger travel 1½"

Holds work securely in jig or fixture for locating and indexing, or comparable operations. Can be switched from "Push" to "Pull" action—or vice versa—in a few seconds. Plunger rod tapped to receive standard ⅜"-16 bolt.

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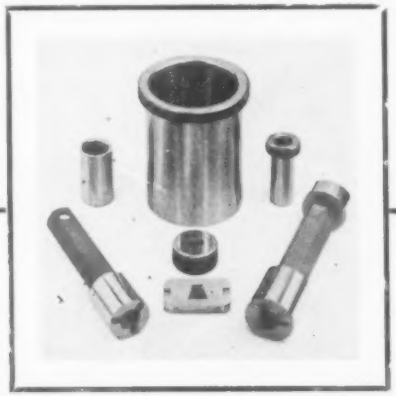

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ECONOMY stands ready, with an engineering staff backed by years of dependable experience, to offer its assistance as a final solution to your DRILL JIG BUSHING and GAGING problems.

Save time and expense by having your UNDERSIZE GAGES reconditioned to original or specified sizes and tolerances, by HARD CHROMIUM PLATING.

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ECONOMY TOOL & MACHINE CO.

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A New Precision Holder for Better Reaming

Here is a reamer holder designed and built by reamer specialists, with the one basic idea of bringing to your turret lathes, hand and automatic screw machines, the full precision qualities inherent in L & I Ground Flute Reamers.

The L & I Precision Centering Reamer Holder employs a new design principle. It quickly establishes a new center absolutely true with the spindle axis, and drives the reamer from this dead center. *Reamer does not float* — but follows true centerline free from weight or pressure. No bushings — no bell-mouthing — no tapered holes — corrects diagonal errors in turrets with worn locks.

Standard model holds reamers from 1/16" to 7/16" diameter interchangeably. Larger model for reamers 7/16" to 1⅛" diameter.

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The Original Oil Hardening, Non-Deforming High Carbon-High Chrome Steel

NEOR is recognized as one of the finest high-carbon, high-chromium steels. For quantity production, NEOR is unsurpassed for dies. Retains a keen edge much longer than carbon or high speed steels. NEOR hardening penetrates to the center of the tool and is non-deforming.
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The power feed feature for facing operations insures smooth, uniform movement of tool across work surface. This power feed can be engaged or disengaged instantly. Adjustment of tool for boring is obtained in increments of 1/10,000 in direct reading.

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For Jig Borer, Drill Press, Milling Machine

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Cutting bar can be set to any position in Tee slot of slide. Hardened and ground throughout. Feed screw and worm ground from solid. Gears and feed nut phospher bronze. Head 3" dia. x 4" long. Wt. 9 lb. Any type shank furnished. Write for complete information.

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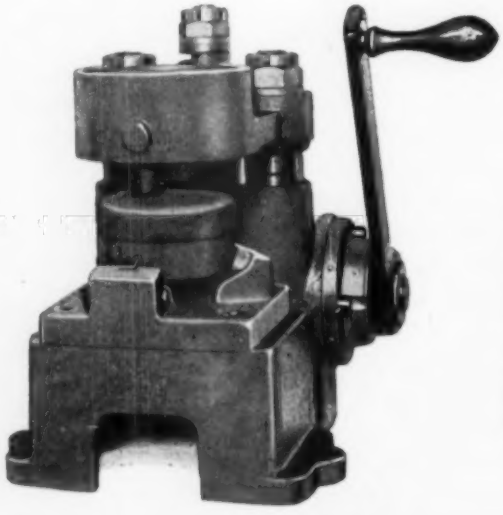

SWARTZ STANDARD DRILL JIGS AND FIXTURE LOCKS

AN APPLICATION SHOWING MERITS OF THE LS TYPE FIXTURE. ROUND PARTS CAN BE HELD AGAINST HEAVY DRILL TORQUE BY MAKING DRILL PRESSURE HELP THE CLAMPING. STEEL INSERTS SET ON ANGLE GRIP PARTS; WHILE TOP PLATE AUTOMATICALLY FOLLOWS UP ANY LOWERING OF THE WORK.

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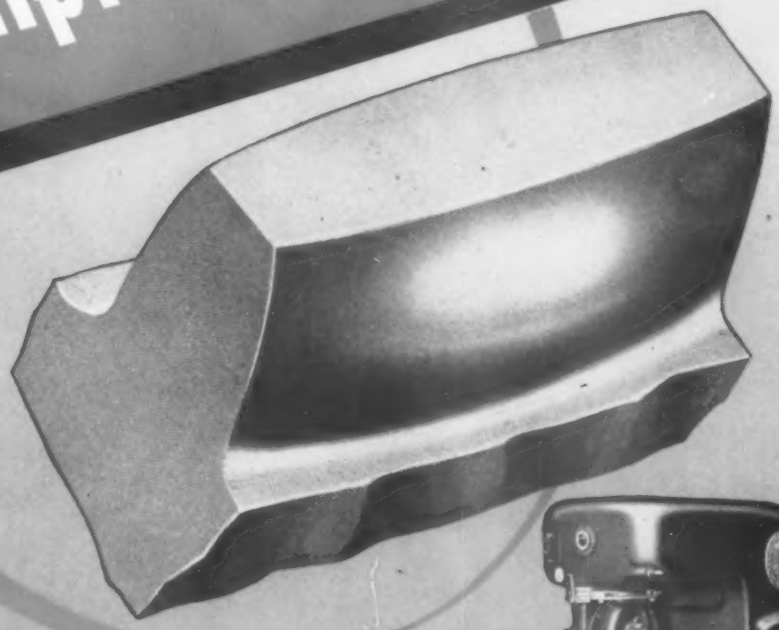
THE MOST IMPORTANT MODERN GEAR DEVELOPMENT IS THE Elliptoid Tooth Form



The Elliptoid (crowned) gear tooth form eliminates the most important cause for gear tooth failure—"end bearing". When the gear tooth load is carried away from the ends of the tooth consistently, its full strength may be relied on. But when the load is concentrated on either end of the tooth, that gear is vulnerable.

The difference in tooth thickness between center and ends need be very little (.0003" to .0005" per inch of face), but when that difference is consistent, the gear develops maximum strength.

Red Ring Rotary Shaving Machines provide the means to give gear teeth Elliptoid Form, in addition to correcting errors in tooth spacing, helical angle, tooth profile, eccentricity and undesirable roughness.

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"NUSITE" — starts with soft high-speed steel and means harder, tougher cutting tools.

"AD-LIFE"—a combination of supplementary treatments to improve hardened finished tools . . . even new ones . . . no re-hardening is required . . . no danger of fracture or distortion. What manufacturers of tools, air planes, trucks, gears, steel molds, food machinery, electrical devices, and many other fields did to improve tool quality and life is told in this valuable booklet.

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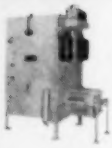

HILCO units use Hilite for purifying mineral oils –*Hiltex or *Adstay for perfect filtering or additive and detergent oils. The HILCO line offers you a complete lubricating, fuel and industrial oil purifier service –Write today for free literature – let us help you take care of "That Particular Job."

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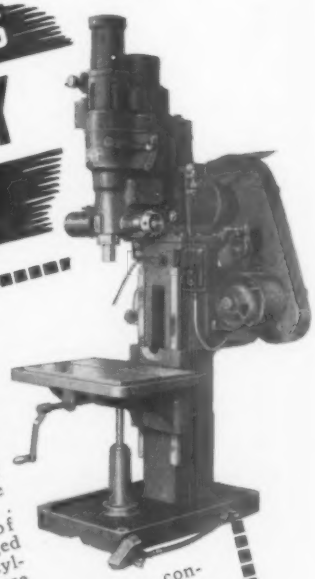

Kaufman No. 10A Hi-Duty single spindle. Lead Screw Tapper made in 3 HP and 1½ HP models, with ¾" N.C. and 1½" N.C. Threads in alloy steel offers these features: Fully enclosed . . . lead screw and nut operate constantly in oil bath . . . positively wearproof clutches instantly engaged and controlled by air cylinder . . . quick traverse when not actually cutting threads . . . accurate depth control . . . control to protect tap overload, and further protected against jamming if work is placed in upside down . . . class 3 fits always assured and perfectly controllable. Complete information upon request.

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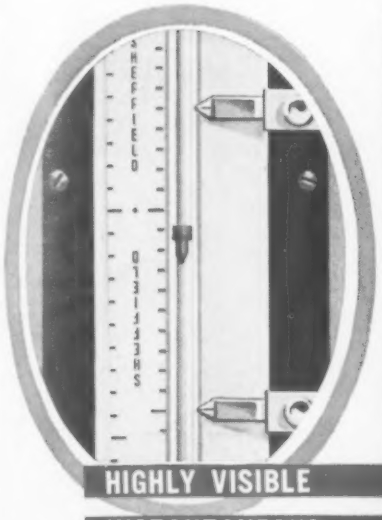

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EASIEST TO READ
NO PARALAX

"There's no guesswork about my job—and darned little scrap! I check every piece, starting with the first, right at the machine—and fast, too! The float tells me where I am—whether or not I am doing a good job and whether the machine and the tools are working okay. If something goes wrong, the float tells me, and adjustments are made right away before any amount of scrap is run."

Sheffield Precisionaires are helping thousands of machine operators to do "tough" jobs without realizing they're tough. High amplification combined with an easy-to-see float that "shows where you are" greatly simplifies the job. Scrap, rework and lost time are substantially reduced—production and assembly are increased in quantity and in quality.

"Chek with Sheffield" as to whether the use of Precisionaires at the machine will make your tough jobs easier.

May we send engineering data . . . and have our representative actually demonstrate the PRECISIONAIRE to you?

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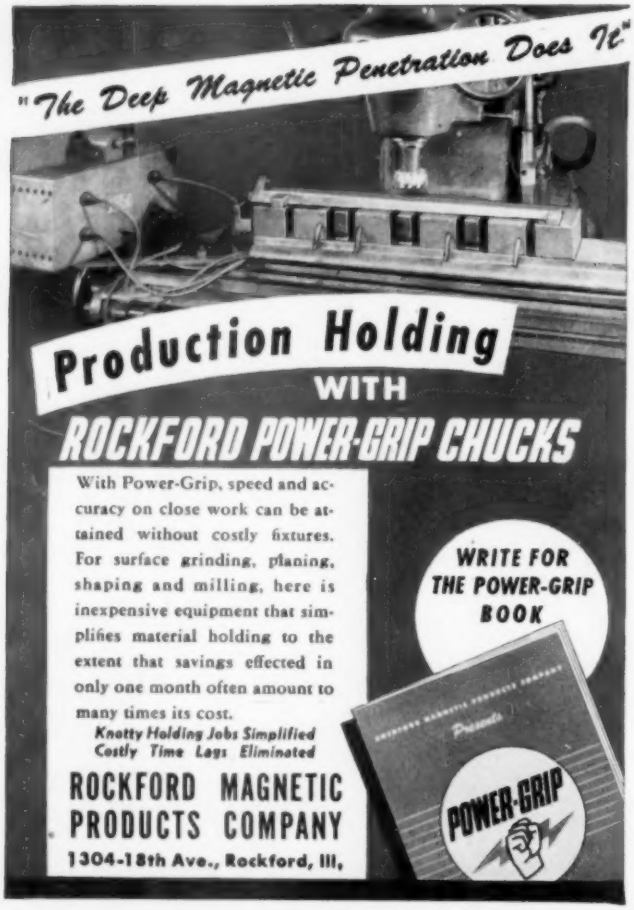
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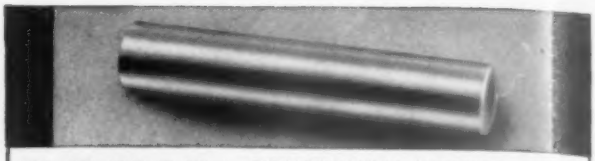

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STANDARD AND .001 OVERSIZE

Hardened and Precision ground to a tolerance of ± .0001 of an inch. Available in .001 oversize for repair or renewal work.

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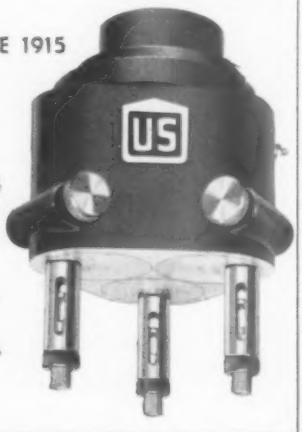

Make TAPS AND REAMERS LAST LONGER!

Here's How!

Before discarding taps and reamers as worn out, try them in a Ziegler Floating Holder and you will find that many of them are still good for a long period of service.

Taps and reamers are often blamed for causing oversize or bell-mouthed holes when the only thing wrong is misalignment of the spindle with the work. By automatically correcting alignment inaccuracies up to 1/32" in radius, the Ziegler Floating Holder enables the tool to perform perfect work even though the set-up may be faulty.

Don't make the mistake of scrapping taps and reamers too hastily. Before calling them worn-out, try them in a Ziegler Holder. It will save you tool expense.

Made to Fit Any Machine

Furnished with male or female taper, straight threaded or special shanks to fit any machine used for tapping or reaming.

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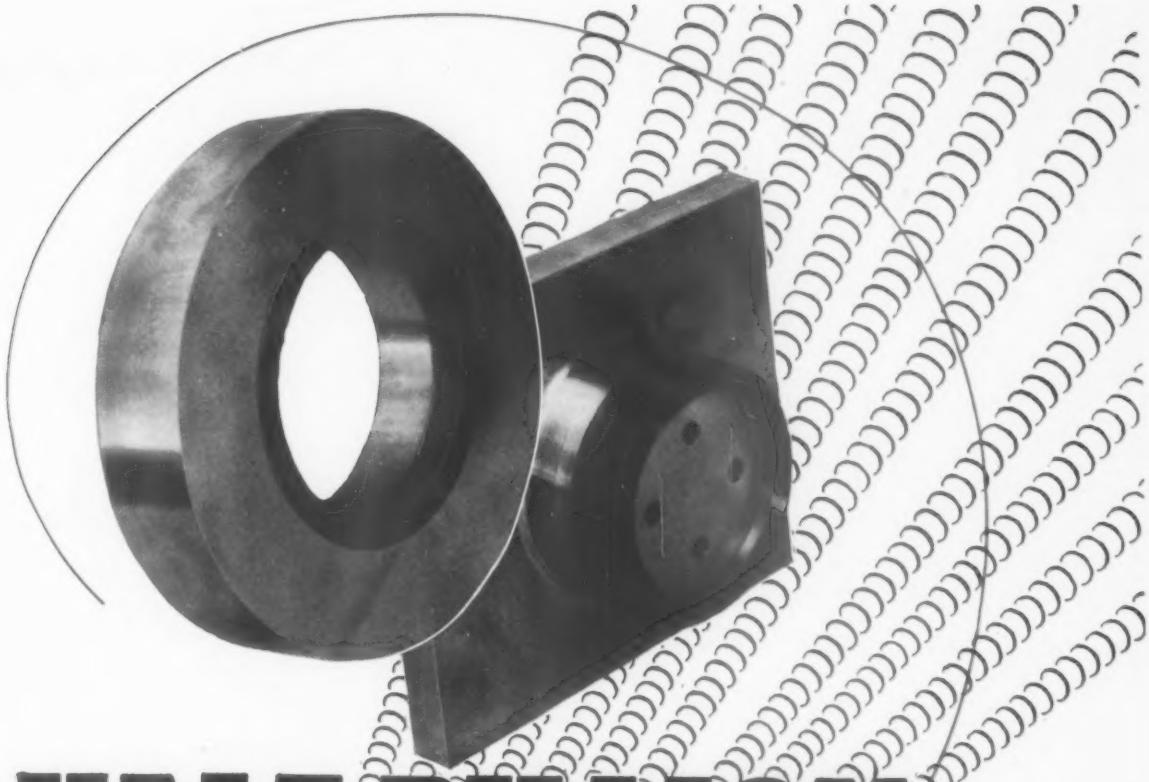
Detroit 16, Mich.

Ziegler ROLLER DRIVE FLOATING HOLDER for Taps and Reamers...



over a HALF BILLION "cookies" .... and STILL GOING

with these Diecarb dies

SEVERAL years ago, in a Pittsburgh electrical manufacturing plant, a disc or "cookie" die was placed in operation. It was made of Diecarb, Firth-Sterling's newest, original, sintered carbide development for blanking dies. This "cookie" die blanked a circle of silicon electrical sheet .025 inch thick, to be used in rotors and stators.

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The original die, at the latest count, had produced the unprecedented total of over a half billion stampings, and was still going!

In fact, the life of these remarkable Diecarb dies is not yet determined because all dies so far made are still in use.

Diecarb can be used for blanking and forming a diversity of materials including metals, plastics, paper, etc. It operates successfully on thicknesses up to 7/16 inch. It is proving unmatchable for high production operations, saving both downtime and maintenance.

If you have a product that requires blanking or if you are planning one—call in Firth-Sterling now to test the possibilities of Diecarb.

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A complete Diecarb engineering service is at your call—for designing complete dies; for aiding in application of Diecarb to die shoes by brazing; shrink-fitting; press fitting and mechanical matrix; and for proper grinding.

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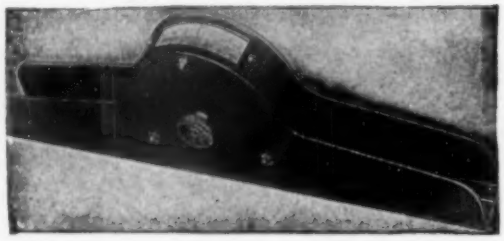
DIRECT — READING

VERNIER ANGLE GAUGE

Provides Desired Exactness EASILY and SIMPLY



Angle gage with a simplicity, accuracy and flexibility not available in any other type of angle measuring device. Outstanding among its exclusive features and advantages are:

DIRECT READING—Employing the gravity principle, the Clinometer indicates an exact angle on the accurately etched graduated scale. Reading is facilitated by the magnifying glass.

VERNIER SCALE—Whole degrees are measured on the main dial; minutes are indicated on the Vernier scale.

ABSOLUTE MEASUREMENT—Clinometer shows the true angle of the measured surface with relation to the absolute horizontal plane.

FULL MEASURING RANGE—Measuring range of 0° to 360° is permitted. Moving rotor has 360 graduations: 0-180° in black, 180-0° in red. Direct reading can be made of any angle in any position, including overhead applications, and without auxiliary equipment.

SELF CHECKING—Accuracy of instrument itself, at any reading, can be checked by placing Clinometer on the same surface, first—left side high; then, right side high—both angles (readings) must be the same, one on the red scale, the other on the black scale. Figure 0 on the main drum is always high.

ACCURACY—Reading accuracy is one minute. Instrument has been tested to a precision of 7½ seconds.

RAPIDITY OF READING—Pendulum movement of rotor can be slowed or stopped by the knob thumbscrew brake. After drum has come to rest and is locked, instrument may be taken off measured surface to read dial.

PREVENTS ERROR—Clinometer is simple to understand. Readings can be made by even semi-skilled or inexperienced workers; so accurate it will eliminate errors and disputes; so rapid in operation, it will frequently double speed of inspection.

PRACTICAL—Clinometer is sturdy, light, simple in construction, unaffected by shocks or vibration. Conveniently carried and ready for immediate use.

MODEL A	MODEL B	MODEL C
Base 14" x 1½", height 4½", weight 2¾ lbs. approx.	Base 6" x ½", height 4½", weight 1¾ lbs. approx.	Length (over straight edge) 14"; width overall 2 7/16"; height (over trammel-pins) 5"; weight 2 lbs. Two trammel pins furnished.

All Models Furnished in Special Instrument Case

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AS A WATCH

ROUND-CHATTERLESS-SMOOTH

GATCO Rotary jig and pilot bushing is built for core drilling, diamond boring, turret tool piloting, piloting hollow mills, line reaming, carbide boring, spot facing, etc.

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applied to Plug Gages

THE Van Keuren Co. have developed a new method of precision plating of wire type and taper insert plug gages. In this modern plant we have combined the best available plating practice with the ability to make precision measurements. We are able to deposit a chromium wear surface accurate to a few millionths of an inch. Gages are finished to the low wear limit and then are plated to the high wear limit. The result is a thin, closely adhering wear surface which will not crack or peal and which is available at a very moderate cost.

Instead of paying 50 to 75% additional for chromium-plated gages, they are now available for only 25% additional and they wear 3 to 5 times as long as steel gages. The many repeat orders which we are getting from large users indicate that this new method is resulting in more prompt deliveries, greater wear, lower gage cost, and satisfied customers. For your next gaging job, specify Van Keuren chrome-plated gages.

Write for your copy of our latest Handbook and Catalog No. 33.

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25th YEAR

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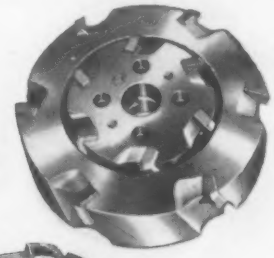

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Cutter for forming bevel on cylinder head valve seat inserts.

Taper shank pilot reamer.

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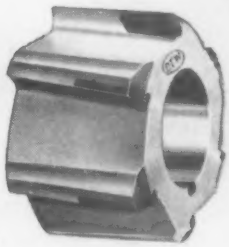

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- Shell Reamers
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INTERNAL WRENCHING

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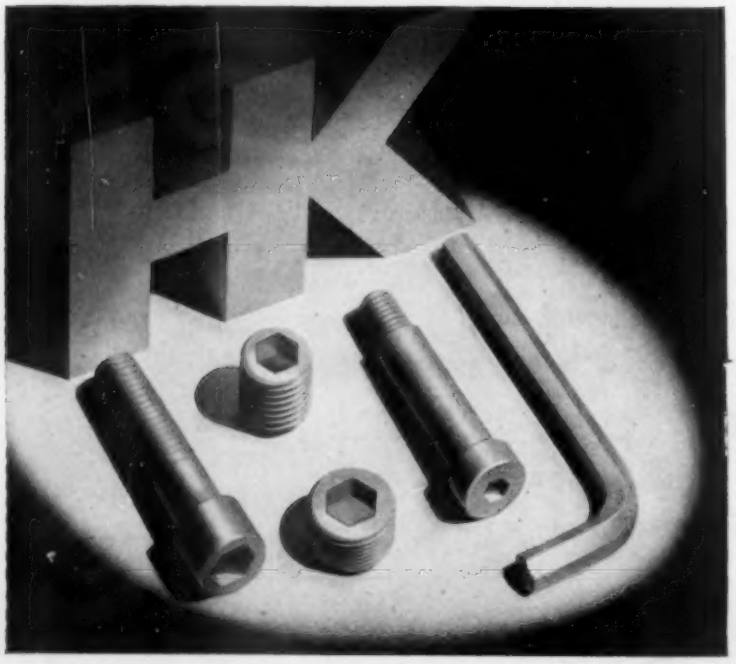

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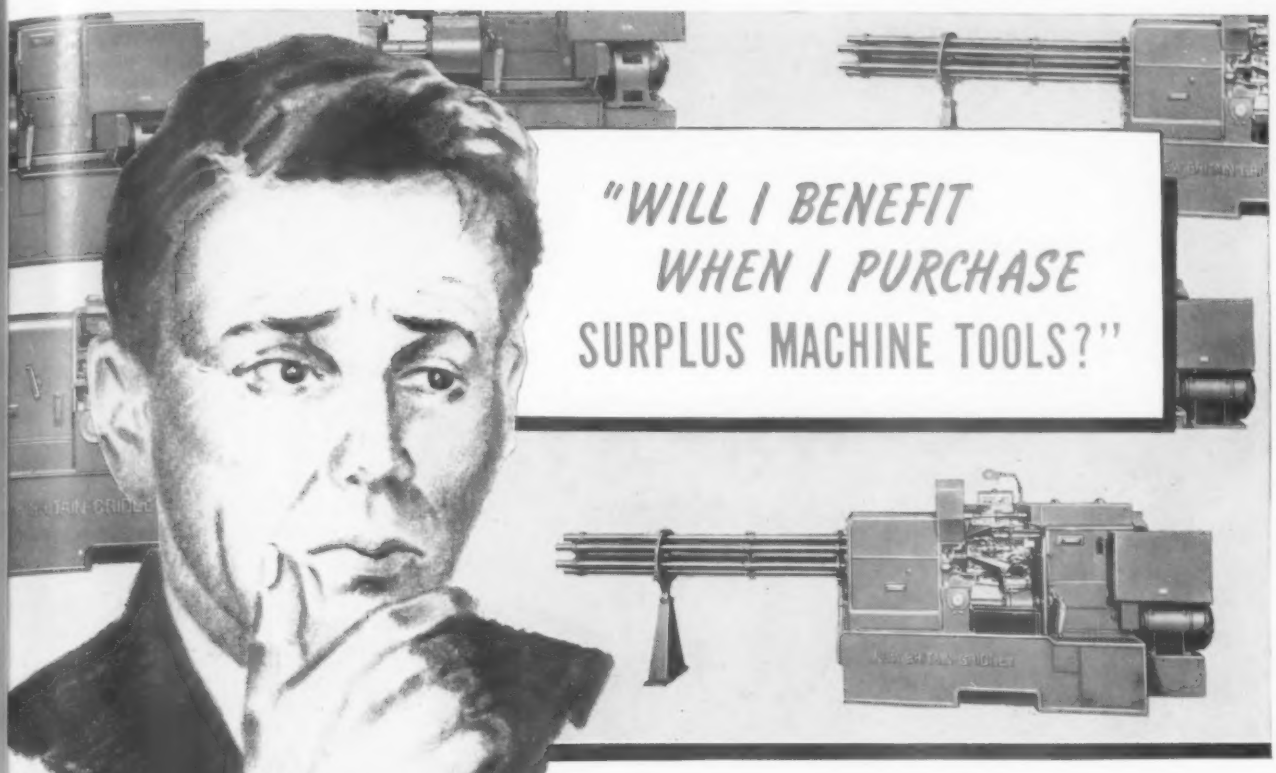

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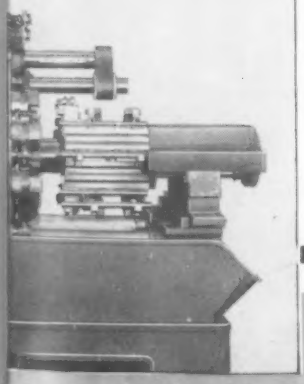

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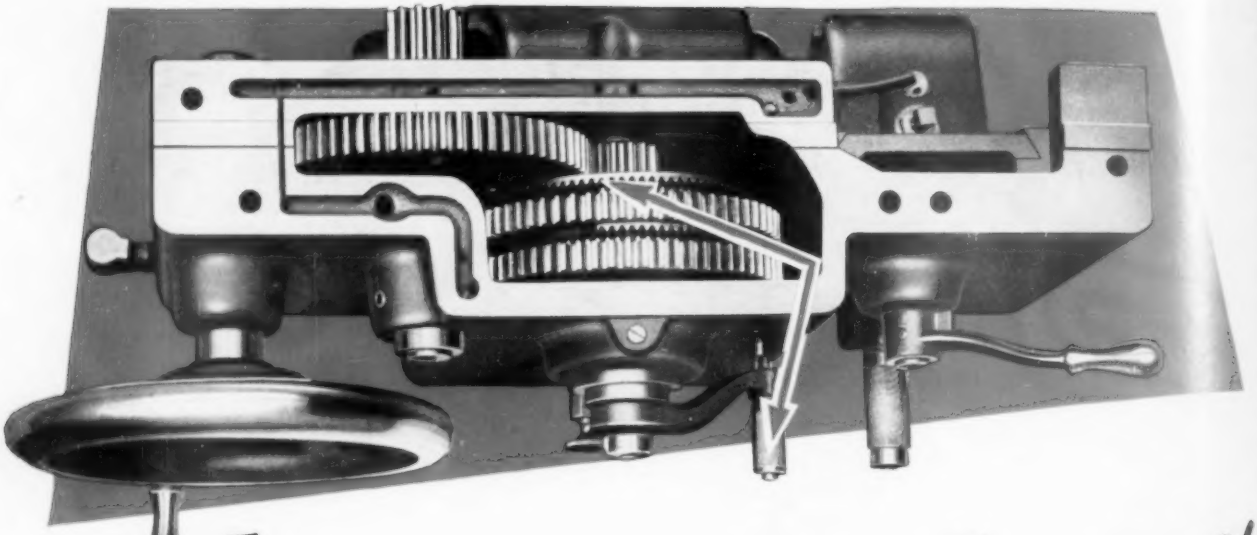

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